

6. Outdoor Lighting and Signs

6.1 Overview

The outdoor lighting and sign energy standards conserve energy, reduce winter peak electric demand, and are technically feasible and cost effective. They set minimum control requirements, maximum allowable power levels, minimum efficacy requirements, and require cutoff classification for large luminaires.

The lighting power allowances are based on current Illuminating Engineering Society of North America (IESNA) recommendations for the quantity and design parameters of illumination, current industry practices, and efficient sources and equipment that are readily available. Data indicates that the IESNA recommendations provide more than adequate illumination, since a 2002 baseline survey of current outdoor lighting practice in California suggests that the majority of establishments currently are illuminated at substantially lower levels than IESNA recommendations.¹¹

Outdoor lighting and sign lighting are addressed in this chapter. Lighting in unconditioned buildings is addressed in Chapter 5.

The Standards do not allow tradeoffs between outdoor lighting power allowances and indoor lighting, HVAC, building envelope, or water heating (§147(a)).

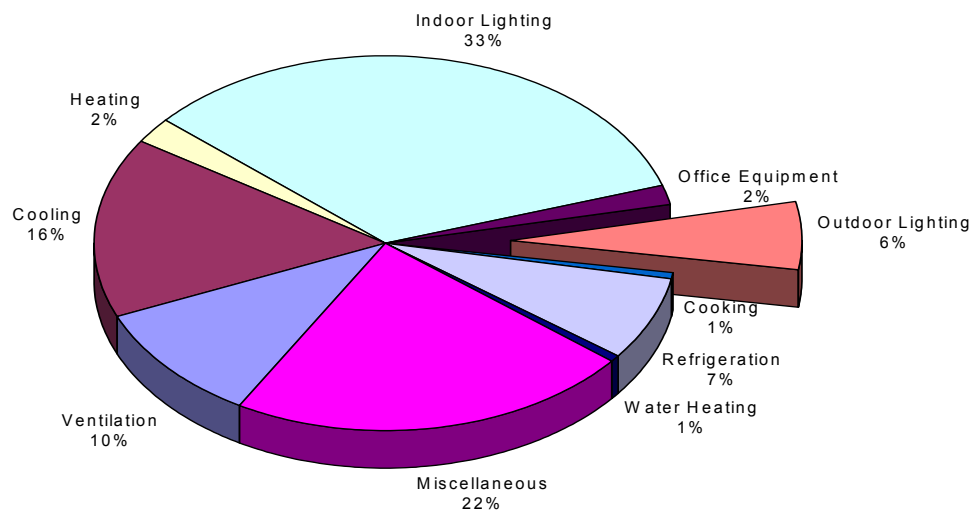


Figure 6-1 – Energy Consumption by End-Use

¹¹ Integrated Energy Systems Productivity and Building Science, Outdoor Lighting Baseline Assessment, New Buildings Institute, August 12, 2002

6.1.1 History and Background

In response to the 2000 electricity crisis, the legislature charged the Energy Commission to develop outdoor lighting energy efficiency standards that are technologically feasible and cost-effective. . The intent of the legislature was that the Standards would provide ongoing reliability to the electricity system and reduce energy consumption.

Regulations for lighting have been on the books in California since 1977, but have only addressed indoor lighting through control requirements and maximum allowable lighting power. With the 2005 Standards the scope is expanded to include outdoor lighting applications as well as indoor applications in unconditioned buildings.

The 2005 Outdoor Lighting Standards evolved over a two-year period through a dynamic, open, public process. The Energy Commission encouraged all interested persons to participate in a series of public hearings and workshops through which the Energy Commission gathered information and viewed presentations on energy efficiency possibilities from a variety of perspectives. The Energy Commission hired a consulting team that included a number of nationally recognized outdoor lighting experts to assist in the development of the Standards. The Energy Commission also solicited ideas, proposals, and comments from a number of interested parties.

6.1.2 Scope and Application

Prior to 2005, the Standards only applied to indoor and outdoor lighting that was associated with conditioned buildings; that is buildings that are heated or cooled. The Standards now address lighting in unconditioned buildings (§146) as well as general site illumination and specific outdoor lighting applications (§147). The lighting applications that are addressed by the Standards are shown in the first two columns of Table 6-1. The first column is general site illumination applications, which allow for tradeoffs. The second column is specific outdoor lighting applications, each of which must comply on their own without tradeoffs. The lighting applications in the third column are not regulated (either controls or lighting power). The Standards include control requirements as well as limits on installed lighting power. The Standards also apply to internally illuminated and externally illuminated signs.

Tradeoffs

Lighting tradeoffs are allowed between the lighting applications included in Standards Table 147-A General Illumination of the Site, which includes hardscape areas, building entrance without canopies, and outdoor sales lots.

The Standards do not allow tradeoffs between outdoor lighting power allowances and indoor lighting, HVAC, building envelope, or water heating [(§147(a)]. No tradeoffs are allowed between the specific lighting applications in Standards Table 147-B (so called use-it or lose-it allowances), or between the lighting applications included in Standards Table 147-B and Standards Table 147-A.

Table 6-1 – Scope of the Outdoor Lighting Requirements

Lighting Applications Covered		
General Site Illumination (tradeoffs permitted)	Specific Applications (tradeoffs not permitted)	Lighting Applications Not Regulated
Hardscape for automotive vehicular use, including parking lots, driveways and site roads Hardscape for pedestrian use, including plazas, sidewalks, walkways and bikeways Building entrances and facades Outdoor sales lots	Building facades Outdoor sales frontage Service stations canopies Vehicle service station hardscape Other sales canopies Non-sales canopies Ornamental lighting Drive-up windows Guarded facilities Outdoor dining	Temporary outdoor lighting Lighting required and regulated by the Federal Aviation Administration and the Coast Guard Public right-of-way Lighting Lighting for sports and athletic fields, and children's playgrounds Lighting for industrial sites Automated teller machine (ATM) lighting Lighting of public monuments Lighting used in or around swimming pools or water features Lighting of tunnels, bridges, stairs, and ramps Landscape lighting
Other outdoor lighting applications that are not included in Standards Tables 147-A, 147-B or 147-C are assumed to be not regulated by these Standards. This includes decorative gas lighting, lighting for theatrical purposes, including, stage, and film and video production, and emergency lighting powered by an emergency source as defined by the California electrical code		

6.1.3 Summary of Requirements

§119, §130, §132, §147 and §148

Mandatory Measures

The Standards require that outdoor lighting be automatically controlled so that it is turned off during daytime hours and during other times when it is not needed. The mandatory measures also require that most of these controls be certified by the manufacturer and listed in the Energy Commission directories. Luminaires with lamps larger than 175 watts must be classified as cutoff so that the majority of the light is directed toward the ground. Luminaires with lamps larger than 60 watts must also be high efficacy or controlled by a motion sensor. More detail on the mandatory measures is provided in Section 6.2.

Lighting Power

The 2005 Standards limit the lighting power for general site illumination and for specific outdoor lighting applications.

- General site illumination includes parking lots, driveways, walkways, building entrances, sales lots, and other paved areas of the site (see column one of Table 6-1). The Standards provide a separate allowance for each of these general site lighting applications, but tradeoffs are permitted among these applications. Essentially, one outdoor lighting budget can be calculated for all these general site applications together. Section 6.4 has more information on general site illumination.

- Specific outdoor lighting applications include building facades, canopies, ornamental lighting, and the front row of car lots (outdoor sales frontage) [see column two of Table 6-1 for a complete list]. Trade-offs are not permitted for specific lighting applications. Each application must comply on its own. Section 6.5.3 has more information on specific lighting applications.

The allowable lighting power for both general site illumination and specific applications are based on four separate outdoor Lighting Zones. The Lighting Zones characterize ambient lighting in the surrounding areas. Sites with higher ambient lighting levels (Zones 3 or 4) have a larger allowance than sites with lower ambient lighting levels (Zones 1 or 2). Section 6.3 has more information on Lighting Zones.

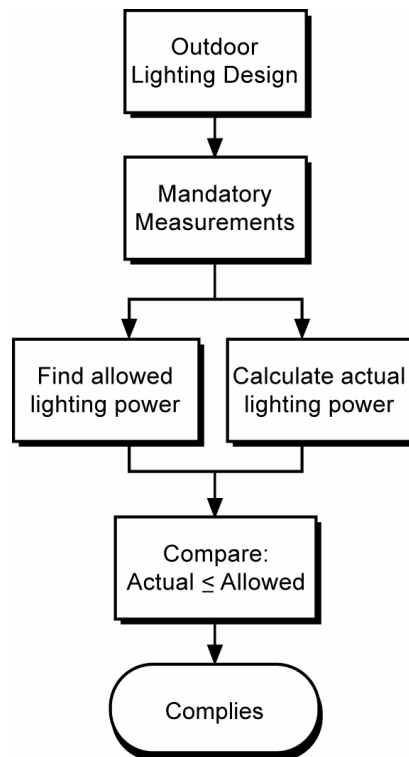


Figure 6-2 – Outdoor Lighting Compliance Flowchart

Signs

For signs, the Standards contain both prescriptive and performance approaches. Sign Standards apply to both indoor and outdoor signs. The prescriptive requirements specify that the signs shall be illuminated with efficient lighting sources (electronic ballasts, etc.) while the performance requirement specifies a maximum power expressed in W/ft² of sign area. Section 6.8 has more information about the requirements for signs.

Installed Power

§130 (c)

The installed power for outdoor lighting applications shall be determined in accordance with §130 (c). Luminaire power for pin-based and high intensity

discharge lighting system types that are listed in ACM Manual Appendix NB may be used as an alternative to determine the wattage of outdoor luminaires. However, luminaires with screw-base sockets, and lighting systems which allow the addition or relocation of luminaires without altering the wiring of the system must be determined in accordance with §130 (c). Please see Chapter 5.4.3 of the Nonresidential Manual, Determining Luminaire Wattage, for additional discussion on installed power. Unlike indoor lighting, no power credits are offered for automatic controls. However, automatic controls are required by the mandatory measures.

6.2 Mandatory Measures

The mandatory features and devices must be included in all outdoor lighting projects when they are applicable. These features have been proven to be cost-effective over a wide range of outdoor lighting applications. The mandatory measures require that the performance of certain equipment be certified by the manufacturers, that lighting systems have controls for efficient operation, that luminaires rated 100 watts or greater be high efficacy or be controlled by a motion sensor and that luminaires using lamps rated greater than 175 watts direct the majority of light toward the ground (cutoff type). Mandatory measures for outdoor lighting and signs are specified in §119, §130, and §132. These are similar to the mandatory measures for indoor lighting.

6.2.1 Certification

§119

Manufacturers of certain lighting control products shall certify the performance of their products to the California Energy Commission. It is the responsibility of the designer, however, to specify products that meet these requirements. Code enforcement officials, in turn, check that the lighting controls specified are indeed certified.

The certification requirement applies to photo controls, astronomical time switches, and automatic controls. Many of these requirements are part of standard practice in California and should be well understood by those responsible for designing or installing lighting systems.

All automatic outdoor lighting control devices must be certified by the manufacturer before they can be installed in a building. The manufacturer must certify the devices to the Energy Commission. Once a device is certified, it is listed in the Directory of Automatic Lighting Control Devices. Call the Energy Hotline at 1-800-772-3300 to obtain more information.

All control devices must have instructions for installation and start-up calibration, must be installed in accordance with such directions, and must have a status signal (visual or audio) that warns of failure or malfunction. Photocell sensors and other devices may be considered exempt from this requirement if the status signal is infeasible because of inadequate power.

Example 6-1

Question

What are the mandatory outdoor lighting requirements?

Answer

The mandatory outdoor lighting requirements include:

Minimum lamp efficacy requirements

Cutoff requirements

Automatic shutoff controls, and

Multi-level switching

All lighting controls must meet the requirements of §119 of the Standards

Example 6-2

Question

What is the responsibility of the lighting designer with regard to using lighting controls that are certified by the Energy Commission and listed in the Energy Commission directories?

Answer

It is the responsibility of the manufacturer to certify the controls and to present the data to the Energy Commission so that it can be listed in the Energy Commission directories. It is the responsibility of the lighting designer to specify controls that have been certified and listed.

6.2.2 Minimum Lamp Efficacy

§132(a)

All outdoor luminaires with lamps rated over 100 watts must either: have a lamp efficacy of at least 60 lumens per watt or be controlled by a motion sensor. Lamp efficacy, for the purposes of complying with §132 (a), is the rated initial lamp lumens divided by the rated lamp power (watts), without including auxiliaries such as ballasts.

This requirement will mostly impact fixtures that are designed for mercury vapor lamps and larger wattage incandescent lamps. Most linear fluorescent, metal halide, and high-pressure sodium lamps have a lamp efficacy greater than 60 lumens per watt and will easily comply. A motion sensor is a device that automatically turns lights off soon after an area is vacated.

The minimum lamp efficacy does not apply, however, to the following applications:

1. Lighting required by a health or life safety statute, ordinance, or regulation, including but not limited to, emergency lighting.
2. Lighting used in or around swimming pools, water features, or other locations subject to Article 680 of the California Electrical Code.
3. Searchlights.
4. Theme lighting for use in theme parks.

5. Lighting for film or live performances.
6. Temporary outdoor lighting.
7. Light emitting diode, neon and cold cathode lighting.

Example 6-3**Question**

I am installing luminaires with 26-watt pin-based compact fluorescent lamps on a school campus. The compact fluorescent lamps have an efficacy of less than 60 lumens per watt. Am I required to put these lamps on a motion sensor?

Answer

No, even though the pin-based lamps are rated at less than 60 lumens per watt, they are less than 100 watt. Therefore, motions sensors are not required.

Example 6-4**Question**

I am installing outdoor fixtures with screw-based sockets and I intend to use 60-W incandescent lamps. Am I required to put these fixtures on motion sensors?

Answer

For fixtures with screw-based sockets it depends on the maximum relamping rated wattage of the fixtures, not on the wattage of the lamps that are used. If the maximum relamping rated wattage of a screw-based fixture, as listed on a permanent factory-installed label is less than or equal to 100 watts then motion sensors are not required. However, if the maximum relamping rated wattage of the fixture, as listed on permanent factory-installed labels is more than 100 watts, or if the fixture is not labeled, then motion sensors will be required.

6.2.3 Cut-Off Luminaires

§132 (b)

Outdoor luminaires that use lamps rated greater than 175 watts in the following areas are required to be of the cutoff type:

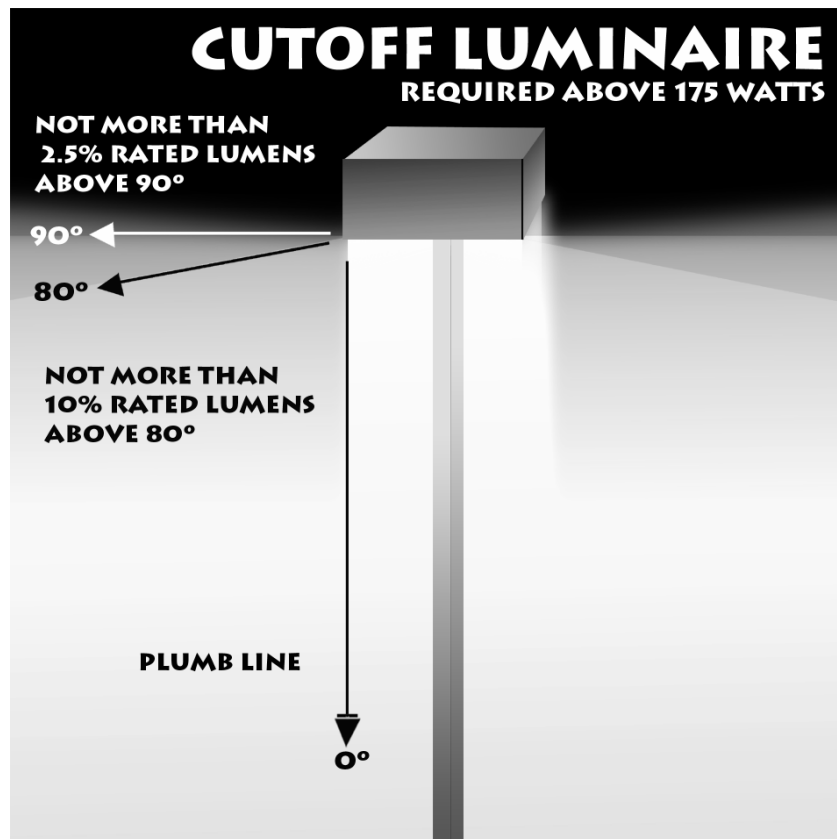
- Hardscape areas including parking lots and service stations hardscape
- Building entrances
- All sales and non-sales canopies
- Outdoor dining
- All outdoor sales areas

Both full-cutoff and cutoff luminaires meet the requirements of this section but only cutoff luminaires are required. To comply with this requirement the luminaire must be rated as “cutoff” in a photometric test report that includes any tilt or other non-level mounting condition of the installed luminaire. A cutoff luminaire is one where no more than 2.5% of the light output extends above the horizon (90

degrees above nadir¹²) and no more than 10% of the light output at or above a vertical angle of 80 degrees above nadir. The definition of cutoff, full cutoff, etc. is illustrated in Figure 6-3.

Cutoff is not required for outdoor luminaires when they are used to illuminate the following:

- Internally illuminated, externally illuminated, and unfiltered signs.
- Lighting for building facades, public monuments, statues, and vertical surfaces of bridges.
- Lighting required by a health or life safety statute, ordinance, or regulation, including but not limited to, emergency lighting.
- Temporary outdoor lighting.
- Lighting used in or around swimming pools, water features, or other locations subject to Article 680 of the California Electrical Code.



¹² Nadir is in the direction of straight down, as would be indicated by a plumb line. Ninety degrees above nadir is horizontal. Eighty degrees above nadir is 10 degrees below horizontal.

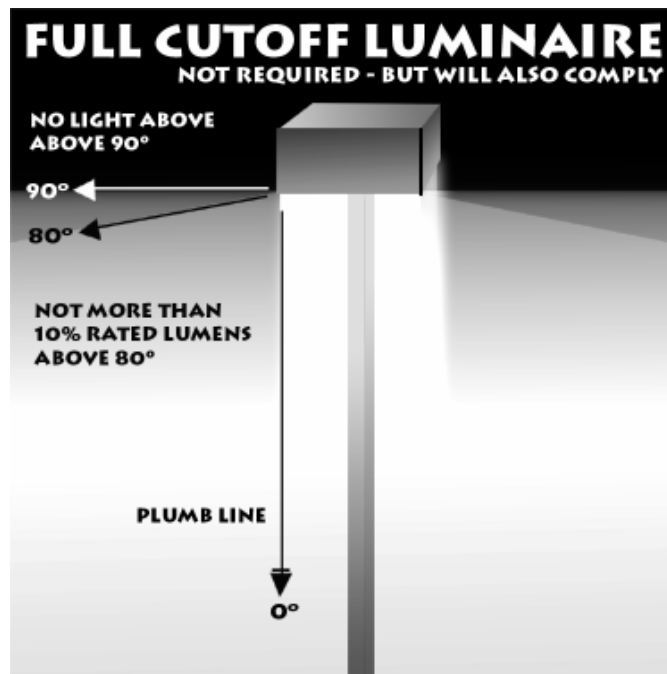


Figure 6-3 – Outdoor Luminaires Classifications

Example 6-5

Question

Am I required to use cutoff luminaires in a rail yard?

Answer

No, only luminaires in areas such as hardscape areas, building entrances, canopies, or outdoor sales areas are required to meet the cutoff requirement. However, in this example, the parking lot outside the rail yard must be equipped with cutoff fixtures.

Example 6-6

Question

Can full-cutoff luminaires be used to meet the cutoff requirements of the Standards in addition to cutoff luminaires?

Answer

Yes, you may use full-cutoff luminaires to meet the requirements of this section. Full cutoff luminaires have superior optics that can very effectively reduce or eliminate disability and discomfort glare, and other negative impacts of high intensity unshielded lighting.

Example 6-7

Question

A parking lot adjacent to a building is being illuminated by 250-watt wallpacks mounted on the side of the building. Do these wall packs have to be cutoff luminaires? The wall packs are also illuminating the façade of the building, but their main purpose is for parking lot illumination.

Answer

Yes, these 250-watt wallpacks will have to be cutoff luminaires because their main purpose is for parking lot illumination. Luminaire mounting methods or locations do not necessarily determine the purpose of the illumination. Each luminaire must be appropriately assigned to the function area that it is illuminating, whether it is mounted to a pole, building, or other structure. Only wallpacks that are 175-watt or less can be non-cutoff.

Example 6-8

Question

Can we use 250-watt, non-cutoff wallpacks for building façade lighting?

Answer

No, Even though façade lighting is exempt from the cutoff requirements, you cannot use non-cutoff wallpacks for façade lighting since most of the light from these fixtures will not illuminate the façade to which they are attached. Only cutoff wallpacks will ensure that most of the light exiting the fixture will illuminate the façade, rather than other areas, such as the parking lots near by. Only wallpacks that are 175-watt or less can be non-cutoff.

Example 6-9

Question

If a cutoff or full-cutoff luminaire is mounted at a tilt does it still meet the cutoff requirement?

Answer

It depends. Luminaires that meet the cutoff requirements when mounted at 90° to nadir may or may not comply with the cutoff requirement when they are mounted at a tilt. In order for a tilted luminaire to meet this requirement a photometric test report must be provided showing that the luminaire meets the cutoff requirements at the proposed tilt, or other non-level mounting condition.

6.2.4 Automatic Shutoff Controls

§132(c)1.

All permanently installed outdoor lighting must be controlled by a photocontrol or astronomical time switch that automatically turns off the outdoor lighting when daylight is available.

Automatic time switch control devices used to control outdoor lighting shall:

- Be capable of programming different schedules for weekdays and weekends; and
- Have program backup capabilities that prevent the loss of the device's program and time setting for at least 10 hours if power is interrupted.

Outdoor astronomical time-switch controls used to control outdoor lighting shall:

- Contain at least 2 separately programmable channels per function area; and
- Have the ability to independently offset the on and off times for each channel by 0 to 99 minutes before or after sunrise or sunset; and
- Have sunrise and sunset prediction accuracy within +/- 15 minutes and timekeeping accuracy within 5 minutes per year; and
- Store time zone, longitude and latitude in non-volatile memory; and
- Display date/time, sunrise and sunset; and
- Have an automatic daylight savings time adjustment; and
- Have automatic time switch capabilities specified in §119 (c).

This requirement does not apply for lighting in parking garages, tunnels, and large covered areas that require illumination during daylight hours.

Controls used to meet this requirement shall be certified by the manufacturer and listed in the Energy Commission directory.

6.2.5 Multi-Level Switching

§132(c)2.

For building facades, parking lots, garages, sales and non-sales canopies, and all outdoor sales areas, where two or more luminaires are used, automatic controls are required to provide the owner with the ability to turn off the lighting or to reduce the lighting power by at least 50% but not exceeding 80% when the lighting is not needed. This switching scenario is sometimes referred to as multi-level switching. Continuous dimming control strategies also satisfy this requirement as long as their dimming range encompasses the 50% to 80% power reduction range.

Exceptions apply to:

- Lighting required by a health or life safety statute, ordinance, or regulation, including but not limited to, emergency lighting.
- Lighting for steps or stairs that require illumination during daylight hours.
- Lighting that is controlled by a motion sensor and photocontrol.
- Lighting for facilities that have equal lighting requirements at all hours and are designed to operate continuously.
- Temporary outdoor lighting.
- Internally illuminated, externally illuminated, and unfiltered signs

There are a number of options available to meet the requirements of this section. Following are a few examples:

- Dimmable lighting systems can be used to meet the outdoor multi-level switching requirements. For HID fixtures, the hi-lo strategy or continuous dimming capable of reducing the connected lighting power by 50% to 80% may be used. For HID and LED fixtures, stepped

dimming is acceptable provided that all the steps are within the 50% to 80% range. LED continuous dimming strategies are acceptable as long as their dimming capacity encompasses the 50% to 80% range. LEDs represent an attractive choice as they can be inexpensively and reliably dimmed.

- When there are two or more fixtures on a single pole, the fixtures can be switched separately
- Every other fixture or pole can be switched separately. This is also known as checkerboard switching
- Every other row of fixtures or poles can be switched separately
- The front half of a parking lot can be switched separately from the back half or sides of the parking lot
- Equip the lighting systems with motion sensors and photoelectric switches. This option works well with fluorescent and LED sources. HID sources may employ the hi-lo strategy with motion sensors.
- Automatic controls to reduce outdoor lighting by at least 50% but not exceeding 80% are required with all of these strategies

Example 6-10

Question

Will a circuit breaker meet the multi-level switching requirements?

Answer

No, circuit breakers are not considered automatic switching. The Standards define automatic as being capable of operating without human intervention.

Example 6-11

Question

The Standards specify that the automatic multi-level switch must be able to reduce the outdoor lighting power by at least 50%, but not exceeding 80%, for certain lighting applications. Can any point between 50% and 80% be chosen to satisfy this requirement?

Answer

Yes, any point between 50% and 80% will satisfy this requirement. This may be a single point or multiple points, as long as they are within this range. Continuous dimming systems also satisfy this requirement as long as their dimming capacity falls in the 50% to 80% range.

6.3 Lighting Zones

6.3.1 Overview

§10-114

An important part of the Standards is to base the outdoor lighting power that is allowed, on how bright the surrounding conditions are. The Standards contain

lighting power allowances for newly installed equipment and specific alterations that are dependent on which Lighting Zone the project is located in.

The technical basis for these differences described by the Illuminating Engineering Society of North America (IESNA), is that the eyes adapt to darker surrounding conditions, and less light is needed to properly see; when the surrounding conditions get brighter, more light is needed to see. The least power is allowed in Lighting Zone 1 and increasingly more power is allowed in Lighting Zones 2, 3, and 4. Providing greater power than is needed potentially leads to debilitating glare, to an increasing spiral of brightness as over-bright projects become the surrounding conditions for future projects causing future projects to unnecessarily require greater power, and to wasting of energy.

The Energy Commission defines the boundaries of Lighting Zones based on U.S. Census Bureau boundaries for urban and rural areas as well as the legal boundaries of wilderness and park areas (see Standards Table 10-114-A). By default, government designated parks, recreation areas and wildlife preserves are Lighting Zone 1; rural areas are Lighting Zone 2; and urban areas are Lighting Zone 3. Lighting Zone 4 is a special use district that may be created by a local government.

Table 6-2 – Standards Table 10-114-A Lighting Zone Characteristics and Rules for Amendments by Local Jurisdictions

Zone	Ambient Illumination	State wide Default Location	Moving Up to Higher Zones	Moving Down to Lower Zones
LZ1	Dark	Government designated parks, recreation areas, and wildlife preserves. Those that are wholly contained within a higher lighting zone may be considered by the local government as part of that lighting zone.	A government designated park, recreation area, wildlife preserve, or portions thereof, can be designated as LZ2 or LZ3 if they are contained within such a zone.	Not applicable.
LZ2	Low	Rural areas, as defined by the 2000 U.S. Census.	Special districts within a default LZ2 zone may be designated as LZ3 or LZ4 by a local jurisdiction. Examples include special commercial districts or areas with special security considerations located within a rural area.	Special districts and government designated parks within a default LZ2 zone maybe designated as LZ1 by the local jurisdiction for lower illumination standards, without any size limits.
LZ3	Medium	Urban areas, as defined by the 2000 U.S. Census.	Special districts within a default LZ3 may be designated as a LZ4 by local jurisdiction for high intensity nighttime use, such as entertainment or commercial districts or areas with special security considerations requiring very high light levels.	Special districts and government designated parks within a default LZ3 zone may be designated as LZ1 or LZ2 by the local jurisdiction, without any size limits.
LZ4	High	None.	Not applicable.	Not applicable.

6.3.2 Lighting Zone Adjustments by Local Jurisdictions

§10-114
Table 10-114-A

The Energy Commission sets statewide default Lighting Zones. However, the jurisdictions (usually a city or county), may change the zones to accommodate local conditions. Local governments may designate a portion of Lighting Zones 2 or 3 as Lighting Zone 4. The local jurisdiction also may designate a portion of Lighting Zone 3 to Lighting Zone 2 or even Lighting Zone 1. When a local jurisdiction adopts changes to the Lighting Zone boundaries, it must follow a public process that allows for formal public notification, review, and comment about the proposed change. The local jurisdiction also must provide the Energy Commission with detailed information about the new Lighting Zone boundaries, and submit a justification that the new Lighting Zones are consistent with the specifications in §10-114 of the Standards.

The Energy Commission has the authority to disallow Lighting Zone changes if it finds the changes to be inconsistent with the specification of Standards Table 10-114-A or §10-114.

Following is a summary of the provisions of §10-114:

Options for Parks, Recreation Areas and Wildlife Preserves

The default for government designated parks, recreation areas, and wildlife preserves is Lighting Zone 1. The local jurisdiction having authority over the property will know if the property is a government designated park, recreation area, or wildlife preserve. However, when a park, recreation area, wildlife preserve, or portions thereof, are surrounded by urban areas (as defined by the U.S. Census Bureau), such areas may be designated as Lighting Zone 3 by adoption of the local jurisdiction. Similarly, a Lighting Zone 2 designation can be adopted if the area is surrounded by rural areas (as defined by the U.S. Census Bureau).

Options for Rural Areas

The default for rural areas, as defined by the U.S. Census Bureau, is Lighting Zone 2. However, local jurisdictions having building permit authority may designate certain areas as either Lighting Zone 3 or Lighting Zone 4 if the local jurisdiction determines that ambient lighting levels are higher than typical for a rural area. Examples of areas that might be designated Lighting Zone 3 are special commercial districts or areas with special security considerations.

Local jurisdictions also may designate default Lighting Zone 2 areas as Lighting Zone 1, which would establish lower lighting power for outdoor areas with lower surrounding brightness. An example of an area that might be changed to Lighting Zone 1 would include an underdeveloped area within a default Lighting Zone 2 area.

Options for Urban Areas

The default for urban areas, as defined by the U.S. Census Bureau, is Lighting Zone 3. Local jurisdictions may designate areas to Lighting Zone 4 for high intensity nighttime use, such as entertainment or commercial districts or areas with special security considerations requiring very high light levels.

Local jurisdictions also may designate areas as Lighting Zone 2 or even Lighting Zone 1 if they deem that this is appropriate.

How to Determine the Lighting Zone for an Outdoor Lighting Project

Permit applicants may determine the Lighting Zone for a particular property through the following steps:

Step 1 - Check with the local jurisdiction having authority over permitting of the property. The local jurisdiction will know if the property is a government designated park, recreation area, or wildlife preserve, and therefore in default Lighting Zone 1. The local jurisdiction also may know if the property is contained within the physical boundaries of a Lighting Zone for which a locally-adopted change has been made. However, verify through step 3 that a locally-adopted change has been submitted to the Energy Commission.

Step 2 - Look at the U.S. Census website to determine if the property is within a rural (statewide default Lighting Zone 2) or urban (statewide default Lighting Zone 3) census tract.

Step 3 - Check the Energy Commission's website to determine if the property is contained within the physical boundaries of a Lighting Zone that has been changed through a local jurisdiction adoption process.

How to Use the U.S. 2000 Census map to determine the default Lighting Zone (LZ)

Go to the US Census page, year 2000 geographic map

http://factfinder.census.gov/servlet/AdvancedGeoSearchMapFramesetServlet?_lang=en&_command=getPlacenames

The US Census Website provides a handy way to determine if a property is in rural (statewide default Lighting Zone 2) or urban (statewide default Lighting Zone 3) census tract.

A link to the U.S. Census Bureau can be found on the California Energy Commission web site: <http://www.energy.ca.gov>.

Energy Commission Web-based List

The Energy Commission maintains a web-based list of local adjustments to the default Lighting Zones. Jurisdictions are required to notify the Energy Commission of the change in designation, with a detailed specification that includes the following information:

- The boundaries of the adopted Lighting Zones, consisting of the county name, the city name if any, the zip code(s) of the re-designated areas, and a description of the physical boundaries within each zip code.
- A description of the public process that was conducted in adopting the Lighting Zone changes.
- An explanation of how the adopted Lighting Zone changes are consistent with the specifications in the Standards.

There are basically two ways to define the physical boundaries of an adopted Lighting Zone: by defining either a single corridor, or defining an area within specific boundaries.

1. Examples of defining a single corridor:

- Properties with frontage on Mazi Memorial Expressway, between Hana Avenue and Elizabeth Street to a depth of 50 feet from each frontage property line.
- The area 500 feet east of Interstate 5, from 500 feet north of Gary Ave to 250 feet south of West William Way.
- The area of the Sara Bike Trail starting at Bryan Avenue and going east to Eurlayne Park, the width of a path which is from the edge of the South Fork of the Randel River on one side, to 100 feet beyond the paved bike trail, or to private property lines, whichever is shorter, on the other side.

2. Example of using an area within specific, well-delineated boundaries:

- The area that is bounded by the Nelson River on the west, Elaine Lane on the south, Jon Road on the east, and the boundary of Beverly County on the north.

Note: The physical boundaries of a changed Lighting Zone are not required to coincide with the physical boundaries of a census tract.

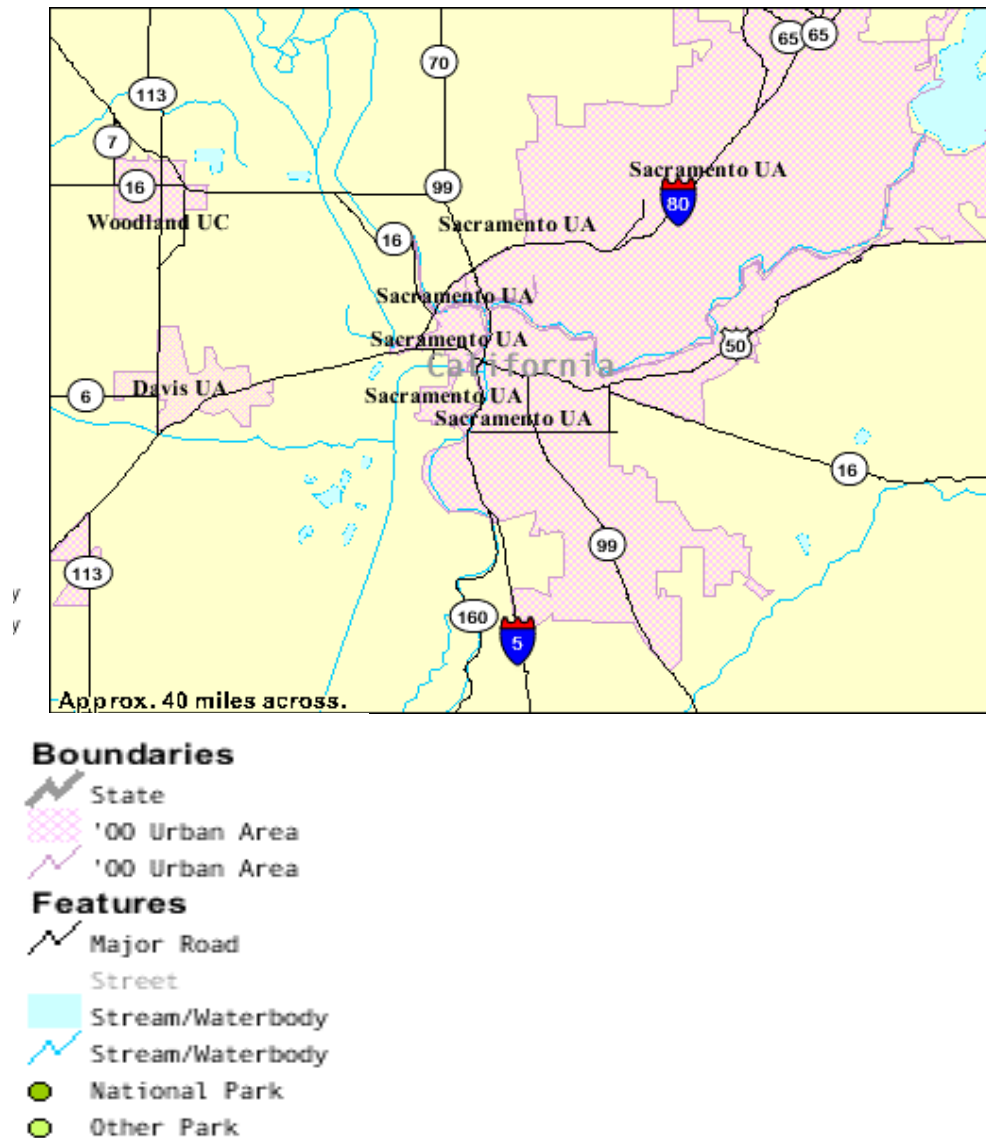


Figure 6-4 – Example of US Census Bureau Information

Example 6-12

Question

I want to have the default outdoor Lighting Zone for a particular piece of property changed. How do I accomplish that?

Answer

Check with the local jurisdiction having authority over the property and ask them what you need to do to petition them to have the default outdoor Lighting Zone officially adjusted.

6.4 Outdoor Lighting Power Allowances

An outdoor lighting installation complies with Standards if the actual outdoor lighting power is no greater than the allowed outdoor lighting power. This section describes the procedures and methods for complying with §147(a).

The allowed lighting power is determined by measuring the area or length of the lighting application and multiplying this area or length times the Lighting Power Allowance, which is expressed either in W/ft² or W/ft, respectively. The allowed lighting power must be calculated for either the general illumination of the site, or for specific applications.

The area of the lighting application must be defined exclusive of any areas on the site that are not illuminated. All outdoor luminaires must be assigned to a specific function area that each is respectively illuminating.

The actual lighting power of outdoor lighting is the total watts of all lighting systems (including ballast or transformer loss). See §147(b).

The allowed outdoor lighting power is calculated by Lighting Zone as defined in §10-114. Local governments may amend Lighting Zones in compliance with §10-114.

6.5 General Site Illumination

(§147(a)) Table 147-A

The Standards impose maximum lighting power limits for general site illumination. General site illumination includes those applications listed in Standards Table 147-A (see also the first column of Table 6-1). These include:

- Hardscape for automotive vehicular use, including parking lots, driveways and site roads.
- Hardscape for pedestrian use, including plazas, sidewalks, walkways and bikeways.
- Building entrances (without canopy).
- Outdoor sales lots.

Hardscape is an improvement to a site that is paved and has other structural features, including but not limited to, curbs, plazas, entries, parking lots, site roadways, driveways, walkways, sidewalks, bikeways, water features and pools, storage or service yards, loading docks, amphitheaters, outdoor sales lots, and private monuments and statuary.

A single lighting budget may be determined for all of these applications together and tradeoffs may be made between the general site illumination applications.

Other outdoor lighting applications are considered *specific applications* as opposed to *general site illumination*. No tradeoffs may be made among or between specific applications.

The allowed lighting power for general site illumination is calculated by determining the area or length of each lighting application and multiplying this area or length times the lighting power allowance, which is expressed either in W/ft² or W/ft, respectively. The area for general illumination of the site may not include areas for specific applications.

The actual lighting power of outdoor lighting is the total watts of all lighting systems (including ballast or transformer loss). See §147(b).

Example 6-13

Question

In a parking lot in front of a retail store, we are not using the maximum lighting power allowance for the parking lot. Can we use the remaining allowance to illuminate the building entrance and the walkways near the store to a higher level?

Answer

Yes, you may use the unused portion of the power allowance in the parking lot to increase the illumination levels for other general site illumination lighting applications in Standards Table 147-A, including building entrance without canopies and walkway areas. However, this tradeoff is not allowed for lighting applications included in Standards Table 147-B.

6.5.1 Illuminated Area

The area of the lighting application may not include any areas on the site that are not illuminated. An area is considered illuminated if it is located within three mounting heights of the nearest luminaire. With indoor lighting applications, the entire floor area is considered to be illuminated for the purpose of determining the allowed lighting power. However, for outdoor lighting applications, the number of luminaires, their mounting heights and their layout affect the illuminated area and therefore the allowed lighting power.

In plan view of the site, the illuminated area is defined as any area within a square pattern around each luminaire or pole that is six times the luminaire mounting height, with the luminaire in the middle of the pattern, less any area that is within a building, under a canopy, beyond property lines, or obstructed by a sign or structure.

The area for general site illumination shall not include any specific applications as defined in Standards Table 147-B. Specific lighting applications must each comply with their own allowed lighting power.

The area of parking lots (including related automobile circulation) and pedestrian plazas is the actual paved area that is illuminated. Planter boxes and other landscaped areas are included as illuminated area, as long as they are less than 10 ft wide and enclosed on at least three sides.

However, for roadways, driveways, sidewalks, walkways or bikeways, the maximum allowed illuminated area may be determined by either of the following methods:

- i. The illuminated area may include the actual paved area plus 5 ft on either side of the centerline path of travel. The lighting power allowance with this method is watts per ft².
- ii. A 25 ft wide area running along the axis of the path of travel and including as much of the paved area of the site roadway, driveway, sidewalk, walkway or bikeway as possible. Any overlapping area of another lighting application must be subtracted from the area of the other lighting application. In this case the allowed lighting power is the length of the centerline of the path times the allowed power per unit length. The lighting power allowances are shown as watts per linear foot in Standards Table 147-A for this calculation method.

With either of the above methods, the illuminated area may not extend beyond the property line.

6.5.2 Lighting Applications

Determine the appropriate lighting application from Standards Table 147-A for each portion of general site illumination. Multiply the allowed area, or length if using hardscape method (ii), of each lighting application by the allowed lighting power density from Standards Table 147-A. Each portion of the illuminated area must be assigned to only one lighting application, and the assigned lighting applications must be consistent with the actual use of the area. Any specific lighting applications (listed in Standards Table 147-B) are excluded from the general site illumination.

Table 6-3 – Standards Table 147-A General Site Illumination LPD Values

Lighting Application	Allowed Area	Watts per square feet, unless otherwise noted			
		Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Hardscape for automotive vehicular use, including parking lots driveways and site roads	Method (i.) Actual paved area plus 5' perimeter of adjacent unpaved land. Includes planters and landscaped areas less than 10' wide that are enclosed by hardscape on at least three sides..	0.05	0.08	0.15	0.19
Hardscape for pedestrian use, including, plazas, sidewalks, walkways and bikeways	Method (i.) Actual paved area plus 5 feet of unpaved land on either side of path of travel. Shall include all continuous paved area before including adjacent grounds.	0.06	0.09	0.17	0.21
Hardscape for driveways, site roads, sidewalks, walkways and bikeways	Method (ii.) 25' wide path incorporating as much of the paved area of the site roadway, driveway, sidewalk, walkway or bikeway as possible.	1.0 w/lf	1.5 w/lf	4.0w/lf	5.0 w/lf
Building Entrances (without canopy)	Width of doors plus 3 ft on either side times a distance of 18 feet outward.	0.35	0.50	0.70	1.00
Outdoor Sales Lot	Actual portion of uncovered outdoor sales lot used exclusively for display of vehicles or other merchandise for sale. All adjacent access drives, walkway areas, customer parking areas, vehicle service or storage areas that are not surrounded on at least three sides by sales area shall be considered hardscape.	0.35	0.70	1.25	2.00

Example 6-14

Question

Lighting for stairs is exempt from the requirements of §147, so is a pole-mounted luminaire that is located at the stairs considered exempt, even though some of the light serves hardscape areas that are not exempt?

Answer

In this example, the luminaire is not regulated by the Standards if the primary purpose for that luminaire is to illuminate the stairs (or other unregulated areas), and majority of light coming from a luminaire falls on stairs. However, the luminaire is regulated by the Standards if majority of the light coming from the luminaire falls on regulated areas, such as hardscape areas. For example, if the luminaire is equipped with optics that directs more than 50% of the light towards the stairs, then the luminaire may be considered stair lighting and therefore exempt. Conversely, the luminaire must be considered hardscape lighting if the lack of proper optical controls results in more than 50% of the light fall on the adjacent hardscape areas. Each luminaire on a site plan must be assigned only one area. It is not the intent of the Standards to assign the wattage of any single outdoor luminaire to more than one area

Example 6-15

Question

A 300 ft long 15 ft wide roadway leads through a wooded area to a hotel entrance in Lighting Zone 2, and the owner wants to light the roadway with luminaires mounted at a height of 20 ft. What is the allowed lighting power for this roadway?

Answer

Lighting power for the roadway may be calculated in one of two ways: based on an allowance of 0.08 W/ft² times the area of the pavement plus 5 ft on each side or based on the length of the roadway times 1.5 W/ft. Using the first method, the allowance is the area of 7,500 ft² (300 ft x 25 ft) times the allowance of 0.08 W/ft² or 600 watts. Using the linear foot method, the allowance is 300 ft of length times the allowance of 1.5 W/ft or 450 watts. In this instance, the area method results in a larger lighting power allowance, but this depends on the width of the proposed paved area. A simple calculation ($1.5 \text{ W/ft} \div 0.08 \text{ W/ft}^2 = 18.75 \text{ ft}$) tells us that the linear foot method will result in more lighting power as long as the width of the roadway (including the 5 ft band on each side) is less than 18.75 ft. In Lighting Zone 3, the breakeven width is 26.67 ft ($4.0 \text{ W/ft} \div 0.15 \text{ W/ft}^2$).

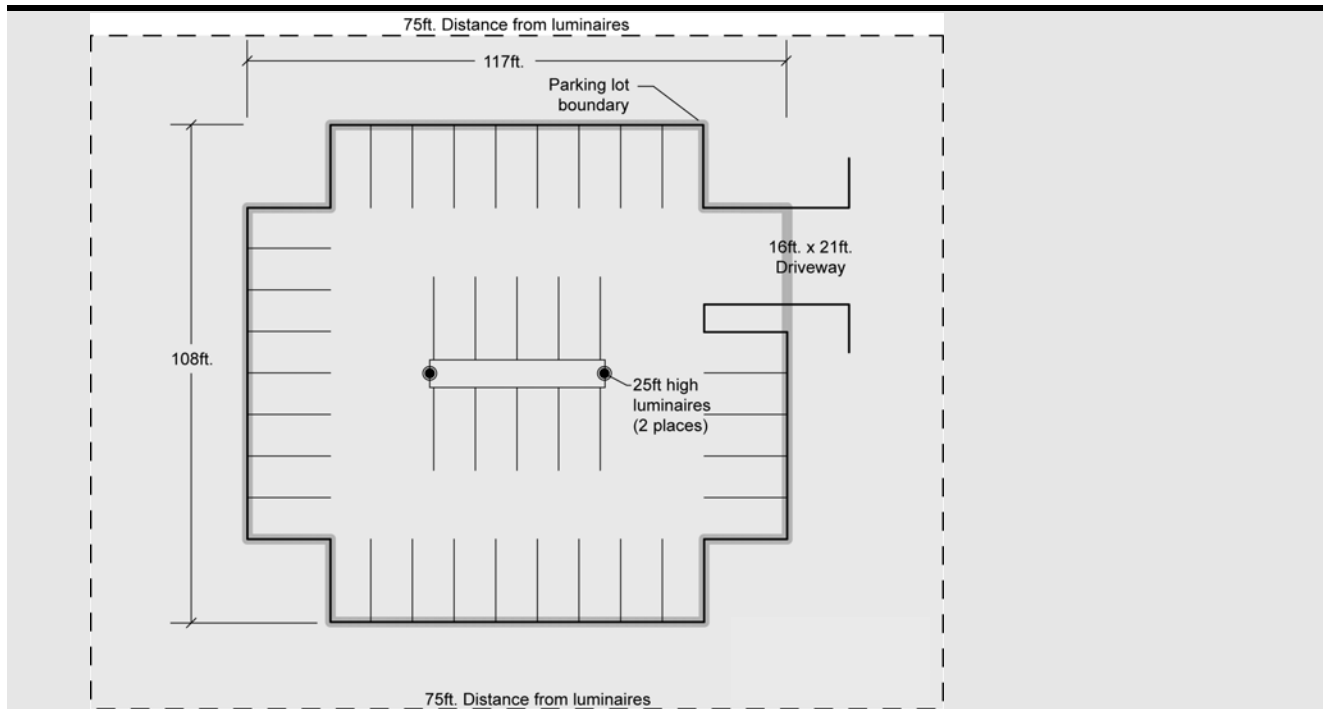
If the roadway were located along the property line, then the additional 5 ft band may not be added on the side adjacent to the property line, e.g. the 5 ft band may not extend onto neighboring property.

Also, the 600 watts calculated above is the maximum power that is allowed and is based on the assumption that the luminaires are spaced in such a way that the entire roadway is illuminated. With the proposed 20 ft mounting height, as long as the luminaires are spaced closer than 120 ft (6 x 20 ft) apart along the roadway, the entire surface may be considered to be illuminated.

Example 6-16

Question

The parking lot illustrated below has two luminaires that are mounted at a height of 25 ft. What is the area of general site illumination and what is the allowed lighting power? The lot is located in Lighting Zone 3.



Answer

The two luminaires create a maximum illuminated area that extends 75 ft (3 x 25 ft) in all four directions. The boundary of the maximum illuminated area extends beyond the edges of the parking lot as well as the entrance drive so the entire paved area is considered illuminated. The landscaped island near the entrance is less than 10 ft wide, so it too is included as part of the illuminated area. The landscaped cutouts (15 x 15 ft) in the corners of the parking lot are bound by pavement on only two sides so they are not included. The illuminated area of the parking lot is 13,986 ft² [12,636 ft² - 900 ft² (cutouts) + 2,250 ft² (5 ft band)]. The illuminated area of the driveway is 16 ft x 21 ft or 336 ft². The total area is 14,322 ft² and the allowance for Lighting Zone 3 is 0.15 W/ft². The maximum power is therefore 2,148 watts.

Example 6-17

Question

In the parking lot layout shown above, what would the illuminated area be and what would the maximum allowed lighting power be if the two luminaires were mounted at a height of 15 feet and the two poles were placed 30 feet apart?

Answer

If the mounting height is reduced to 15 ft, then the illuminated area is 120 ft by 90 ft. The top 9 feet and bottom 9 feet of the parking lot must be excluded from the illuminated area of the parking lot.

6.5.3 Adjustments to Outdoor Lighting Power Allowances

The general site outdoor lighting power allowances permit lighting designs that deliver appropriate light levels as recommended by the Illuminating Engineering Society of North America (IESNA). In addition, the lighting power allowances are based on meeting IESNA recommendations for illumination quantity and quality and through the use of reasonably efficient sources and equipment that are readily available on the market. Minimum safety requirements have already been taken into consideration. Conservative assumptions were used in developing the Standards so, most often, it is possible to achieve illumination levels considerably higher than the minimums recommended by IESNA by simply using different performance parameters than were used to develop the lighting power allowances. The different performance parameters could include a more efficacious lighting technology, like pulse-start metal halide lamps or high-pressure sodium lamps, and by using cutoff rather than full-cutoff luminaires.

Adjustments For Local Ordinances

*Exception 1 to 147(c)1.B.
Table 147-C*

When higher light levels are required by law, through an officially adopted local ordinance by the authority having jurisdiction, and when the allowed lighting power density is inadequate to provide the required higher light levels using efficient lighting technologies (like pulse start metal halide, fluorescent T8 and T5 sources, or high pressure sodium lighting systems), then the allowed lighting power density specified in Table 147-C may be used to meet the higher light levels (See Exception 1 to §147(c)1.B.). This exception applies to general site illumination only and in particular to parking lots, site roadways, driveways, sidewalks, walkways, and bikeways. The higher value from Standards Tables 147-A or 147-C may be used for such applications.

The LPD values in Table 147-C are based on “average” footcandle levels. If the local ordinance calls for “minimum” footcandle levels, multiply the “average” footcandle levels by a factor of two. For example, if a local ordinance calls for “minimum” of one footcandle level, then instead of using the one footcandle level at 0.07 W/ft², use two footcandle levels at 0.12 W/ft². If multiplying the “average” footcandle levels result in a value that is greater than four footcandles, simply extrapolate the 0.25 W/ft² value of the “average” four-footcandle level. For example, a “minimum” of three footcandles is equivalent to six “average” footcandles. Extrapolating for 0.25 W/ft² results in 0.38 W/ft².

Table 6-4 – Standards Table 147-C Required Light Levels by Law through a Local Ordinance

Required light levels by law through a local ordinance (horizontal foot-candles, average)	Allowed Lighting Power Density (W/ft ²)
0.5	0.05
1.0	0.07
1.5	0.10
2.0	0.12
3.0	0.19
4.0 or greater	0.25

Example 6-18

Question

If the parking lot shown in the previous examples (with 25 ft mounting height) were in a jurisdiction that required a minimum of 2 footcandles of parking lot illumination, what would be the allowed lighting power?

Answer

Referring to Standards Table 147-C, the allowed lighting power density for 2 footcandles is 0.12 W/ft², which is lower than the 0.15 allowed for Lighting Zone 3, so no additional power would be permitted. However, if the local ordinance required an average 3 footcandles, then the maximum lighting power density would be 0.19 W/ft² and lighting power could be increased to 0.19 W/ft² x 17,400 ft² or 3,306 watts.

Adjustments For Security

*Exception 2 to 147(c)1.B.
Table 147-D*

In some situations higher lighting levels may be required because of special security requirements. Lighting power may be increased by values in Standards Table 147-D for security reasons in three cases:

- For retail parking lots in Lighting Zones 1, 2, and 3, the lighting power allowance from Standards Table 147-A may be increased by 25% (multiply the value by 1.25).
- For hardscape areas (plazas, pedestrian ways, parking, or roadways) within 100 ft of the entrance of senior housing facilities, the lighting power allowance from Standards Table 147-A may be increased by 25% (multiply the value by 1.25).
- For parking lots and walkways within 60 ft of building entrances for law enforcement, fire, ambulance and emergency vehicle facilities, the lighting power allowance from Standards Table 147-A may be doubled (multiply the value by 2.0).

When the security adjustment is used, the areas affected shall be considered special applications and no tradeoffs are permitted. The area of security lighting is dropped from the area of general site illumination and it is treated as a special use-it-or-lose-it allowance. Luminaires that are used for this special security lighting shall not create illuminated area for the purpose of determining general site illumination.

Table 6-5 – Standards Table 147-D Adjustments for Security

Function Area	Multiplier
Retail parking lots in Lighting Zones 1, 2 and 3	1.25
Hardscape areas within 100 feet of the entrance of senior housing facilities in Lighting Zones 1, 2, and 3	1.25
Parking lots and walkways within 60 feet of entrances to the building for law enforcement, fire, ambulance and emergency vehicle facilities	2.0

Example 6-19

Question

If the parking lot in the previous example served a retail store, what would be the lighting power allowance?

Answer

The 2,610 watts may be increased by 25% to 3,262 watts. This is calculated by multiplying the 2,610 watts by 1.25, which is taken from Standards Table 147-D.

Example 6-20

Question

What lighting power is permitted for the parking lot shown below? The site is located in Lighting Zone 3.

Answer

The 20 ft high luminaires create a maximum illuminated area (three mounting heights) that encompasses the entire lot, so the limits of the illuminated area are defined by the paved areas. The landscaped median in the center of the parking lot is more than 10 ft wide so it is not included in the parking lot area. The landscaped areas that are less than 10 ft wide are included as part of the illuminated area.

$$(100 \text{ ft} \times 140 \text{ ft}) + (100 \text{ ft} \times 20 \text{ ft}) - (40 \text{ ft} \times 60 \text{ ft}) = 13,600 \text{ ft}^2$$

For Lighting Zone 3, the allowed lighting power is 0.15 W/ft² so the maximum power is 2,040 watts. Each of the four luminaires can be a maximum of about 500 watts.

Example 6-21

Question

A parking lot is illuminated from a series of cutoff wallpacks mounted on an adjacent building. The luminaires are mounted at a height of 15 ft above the ground and spaced 50 ft apart. How large is the illuminated area? What are the maximum rated watts that are permitted for each of the luminaires? The building is located in Lighting Zone 2.

Answer

The illuminated area extends a distance equal to 3 times the mounting height. The illuminated area therefore extends from the building a distance of 45 ft. The total illuminated area is 45 ft x 290 ft or 13,050 ft². The allowed lighting power in Lighting Zone 2 is 0.08 W/ft² so the maximum power is 1,044 watts. Each luminaire can have a maximum size of about 208 watts.

Example 6-22

Question

In the example above, if you substitute sconces for the wall packs and keep the same arrangement on the wall, what would be the allowed lighting power?

Answer

In this case, the allowance would be based on façade lighting, not parking lot lighting. Façade lighting is a specific lighting application so no tradeoffs are permitted with parking lot lighting and the luminaires can not be counted toward creating general site illumination. The Lighting Zone 2 allowance for façade lighting is 0.18 W/ft² and the surface being illuminated is the entire wall. The area of the wall is 260 ft x 20 ft or 5,200 ft². The maximum power is 936 watts.

Example 6-23**Question**

If a pole has a height of 15 ft, what are the dimensions of the square pattern used for power calculations?

Answer

The illuminated area is defined as any area within a square pattern around each luminaire or pole that is six times the luminaire mounting height, with the luminaire in the middle of the pattern, less any area that is within a building, under a canopy, beyond property lines, or obstructed by a sign or structure. Therefore, for a 15-ft pole, the area will be described by a square that is 90 ft (15 ft X 6) on each side, or 8,100 ft² (90ft x 90ft), minus areas that are beyond the property line or other obstructions.

Example 6-24**Question**

If two poles in the center of an illuminated area are a greater distance than 6 times the mounting height, will all of the square footage between them be included in the area?

Answer

The illumination area for each pole is determined as the area within a square pattern around each pole that is six times the luminaire height (usually the pole height). In most applications, for example parking lots, these square patterns will overlap, so the entire area of the parking lot may be used as the basis for the lighting power budget. However, if the poles are so far apart that squares do not overlap, then each square determines the illumination area for each pole for the purpose of lighting budget. In this case the entire parking lot area may not be used for the basis of lighting budget. This procedure means that unlighted areas are not used for allowed power calculations.

Example 6-25**Question**

Is the parking lot outside of a hospital ("I" occupancy) regulated by the Standards?

Answer

No. Hospitals are "I" type occupancies and are not covered by Title 24 Building Energy Standards. This includes all outdoor areas. The same is true for all other "I" type occupancies such as detention facilities.

Example 6-26**Question**

How do I determine if I should use the actual paved area (watts per ft² allowance) or a 25-ft wide area (watts per linear foot allowance)?

Answer

You may try both lighting budget calculations and choose the one that is most appropriate for to your situation.

Example 6-27**Question**

We have a five-story parking garage. The top level is uncovered. What are the lighting Standards requirements for this garage?

Answer

Since the lower four floors have a roof, they are considered indoor unconditioned buildings and must comply with the requirement of Standards Table 146-C. For these levels, indoor compliance forms LTG-1-C, LTG-2-C, and LTG-3-C may be required. The uncovered top floor is considered a parking lot and therefore must comply with the hardscape requirements of Standards Table 147-A. An outdoor lighting compliance form, such as OLTG-1-C and OLTG-2-C may be required for the top level.

Example 6-28

Question

Our overflow parking lot is covered with gravel. Is this parking lot considered “hardscape” and must it comply with Table 147-A requirements?

Answer

Yes, parking lots covered with gravel, or any other material used to enhance the surface to accommodate parking or travel, such as pavers, asphalt, cement, or other pervious or non-pervious materials are considered hardscape and must comply with the requirements for hardscape areas.

Example 6-29

Question

What is the allowed lighting power for a 15,000 ft² retail parking lot located in Lighting Zone 2?

Answer

Standards Table 147-A specifies a lighting power density of 0.08 W/ft² for hardscape including parking lots in Lighting Zone 2 (hardscape for automotive use, method i). Since this is a retail parking lot, Standards Table 147-D, permits a multiplier of 1.25, which can be used to increase the allowed power. The maximum allowed lighting power for this parking lot is therefore:

$$0.08 \text{ W/ft}^2 \times 1.25 \times 15,000 \text{ ft}^2 = 1,500 \text{ watts}$$

Example 6-30

Question

We believe that we need more lighting power than Standards allow. Can we use Standards Table 147-C to get more power?

Answer

There must be an officially adopted local ordinance by the jurisdiction having authority that permits higher illumination levels before Standards Table 147-C can be used.

6.6 Specific Lighting Applications

§147(a) Table 147-B

The allowance for specific lighting applications are given in Standards Table 147-B. These include

- Building facades.
- Outdoor sales street frontage.
- Vehicle service stations with or without canopies.
- Vehicle service station hardscape.
- All other sales canopies.
- Non-sales canopies.
- Ornamental lighting.
- Drive up windows.
- Guarded facilities.
- Outdoor dining.

Each of these specific lighting applications shall comply with the standard on their own. Tradeoffs are not permitted between specific lighting applications or with general site illumination.

The allowed lighting power for specific lighting applications is the smaller of the product of the area of the each lighting application and the allowed lighting power density foot from Standards Table 147-B, or the actual power used to illuminate this area. Luminaires qualifying for these allowances shall not be used to determine allowed lighting power for general site illumination or any other specific application.

6.6.1 Building Facades

§147(c)2.A.

A building façade is the exterior surfaces of a building, not including horizontal roofing, signs, and surfaces not visible from any reasonable viewing location. Building facades and architectural features may be illuminated by flood lights, sconces or other lighting attached to the building. Building façade lighting is not permitted in Lighting Zone 1. Only the illuminated façade area may be counted when calculating the allowance for façade lighting. Façade orientations that are not illuminated and façade areas that are not illuminated because the lighting is obstructed shall not be included. General site illumination and/or lighting for other specific applications can be attached to the side of a building and not be considered façade lighting. However, every luminaire must be assigned to only one specific lighting application. Unshielded wallpacks mounted on sides of the buildings are not considered façade lighting, since most of the light exiting these fixtures lands on areas other than the building façade.

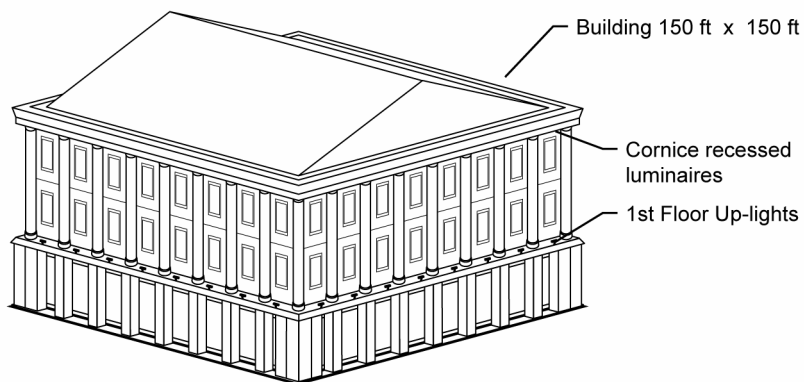


Courtesy of Horton Lees Brogden Lighting Design, Inc of San Francisco
Photographer: Jay Graham

Figure 6-5 – Façade Lighting

Example 6-31

Question



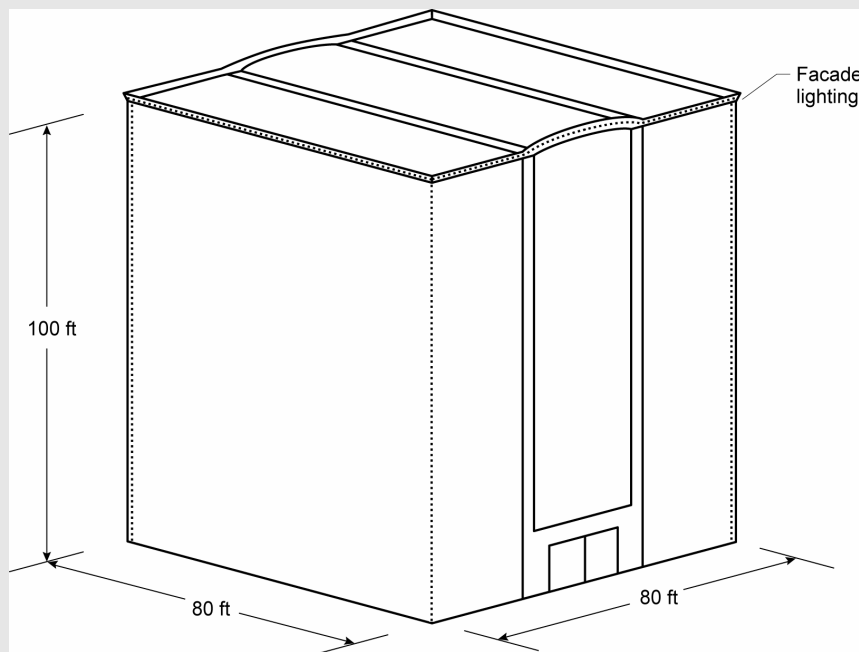
(Lighting Zone 3) wants to illuminate its city hall on two sides. The structure is a three-story building with a colonnade on the second and third floors and a cornice above. The columns are considered important architectural features and the principal goal of the lighting job is to highlight these features. The columns are 30 ft tall x 3 ft in diameter and are spaced at 8 ft. For the purposes of determining the lighting power allowance for the building, what is the surface area to be illuminated? What is the lighting power allowance? The columns will be illuminated by downlights at the cornice and uplights above the first floor.

Answer

The area of the façade for the purposes of calculating the lighting allowance is the projected area of the illuminated façade. Architectural features such as columns, recesses, facets, etc. are ignored. The illuminated area is therefore 30 ft x 150 ft or 4,500 ft². The façade allowance for Lighting Zone 3 is 0.35 W/ft², so the total power allowed is 1,575 watts.

Example 6-32**Question**

I am designing a high-rise building and permanently mounted marquee like lights will be installed along the corners of the building. The lights will be turned on at night, but only for the holiday season, roughly between mid-November and mid-January. The lights consist of a series of 9 watt compact fluorescent luminaires spaced at 12 in. on-center (OC) along all the corners of the building and along the top of the building. Essentially, the lights provide an outline of the building. For the purposes of the outdoor lighting Standards, are these considered façade lighting? Since they will only be used for about two months of the year, are they considered temporary lighting and exempt?

**Answer**

The lighting is permanent lighting and must comply with the Standards. Temporary lighting is defined as “cord and plug” lighting. Anything that is permanently mounted to the building is considered permanent lighting, and the hours of intended use do not affect its status as permanent lighting.

Since this lighting is primarily used to accent the architectural outline of the building, it may be considered façade lighting. And since all corners of the building are illuminated, all four facades may be considered to be illuminated. The area on each façade is 80 ft x 100 ft or 8,000 ft². The total illuminated area is four times 8,000 ft² or 32,000 ft². The Lighting Zone 3 allowance for façade lighting is 0.35 W/ft² and the total power allowance for façade lighting is 11,200 watts.

There are 100 ft x 4 plus 80 ft x 4 lamps (a total of 720 lamps) on the building. Each lamp is 13 watts (including the ballast). This data is taken from Appendix NB of the Nonresidential ACM Manual. The

installed power is 720 lamps times 13 W/lamp or 9,360 watts. The installed power is less than the allowance so the façade lighting complies. If this building were in Lighting Zone 2, the allowance would be 0.18 W/ft² or a total of 5,760 watts. The lighting design would not comply in Lighting Zone 2.

Example 6-33

Question

In the example above, if only the front corners the building are illuminated, which façade area should be the basis of the allowed lighting calculations?

Answer

Since the corners are at the intersection of two facades (for example, the front and right facades), only one or the other facades areas (but not both) may be used to calculate the power allowance.

Example 6-34

Question

Portions of the front façade of a proposed wholesale store in Lighting Zone 3 are going to be illuminated. The front wall dimensions are 120 ft by 20 ft. There is 250 ft² of fenestration in the front wall that is illuminated by the façade lighting. Signs cover another 500 ft² of the front wall, and another 400 ft² is not illuminated at all. What is the allowed front façade lighting power?

Answer

The gross wall area is 2,400 ft² (120x20). However we must subtract all those areas that are not illuminated. Please note that since the 250 ft² of fenestration is intended to be illuminated by the façade lighting, this area may be included in the total area eligible for power calculations. The areas not eligible for power calculations include:

500 ft² of signs + 400 ft² of unlighted façade = 900 ft²

Net wall area used for façade lighting: 2,400 ft² – 900 ft² = 1,500 ft²

From Table 147-B, the allowed façade lighting power density in Lighting Zone 3 is 0.35 W/ft²

The calculated allowed power based on net wall area is 1,500 ft² x 0.35 W/ft² = 525 watts.

The allowed power is therefore the smaller of actual façade lighting power or 525 watts.

Example 6-35

Question

Is sign lighting part of my façade lighting?

Answer

If lighting is used only to illuminate a sign then that lighting is not part of the façade lighting. However, the sign area must be subtracted from the façade area so that the area is not double counted. The sign lighting must meet the requirements of the Standards for sign energy efficiency or allowed power.

Example 6-36

Question

Is the lighting of my parapet wall with small wattage lamps decorative lighting considered ornamental or façade lighting?

Answer

Small wattage lamps attached to a building façade is considered façade lighting. Ornamental lighting is defined in Standards as post-top luminaires, lanterns, pendant luminaires, chandeliers, and marquee lighting.

Example 6-37

Question

If I mount a luminaire on the side of my building to illuminate an area is it considered façade lighting or hardscape lighting?

Answer

It depends on the primary intent of the luminaire. For example, if the luminaire is primarily illuminating the walls (such as a sconce), then it should be considered part of the building façade lighting. If on the other hand, the luminaire is primarily illuminating the parking lot beyond (most wall packs), then it should be part of the hardscape lighting. It should be noted that lighting power tradeoffs are not allowed between building façade and hardscape areas, which means you cannot use both allowances for the same luminaire.

6.6.2 Sales Frontage

§147(c)2.B.

While outdoor sales areas in the category of general site illumination, the portion of the lot along the street may qualify for additional lighting power. This additional allowance is intended to accommodate the retailers need to highlight merchandise to motorists who drive by their lot. Outdoor sales frontage includes car lots, but can also include any sales activity.

The allowed lighting power for outdoor sales frontage is the smaller of the product of the frontage (in feet) and the allowed lighting power density per foot from Standards Table 147-B, or the actual power used to illuminate the frontage.

Sales frontage is immediately adjacent to the principal viewing location and unobstructed for its viewing length. A corner sales lot may include both sides provided that a different principal viewing location exists for each side. Measured in plan view, only sections of the outdoor sales area that are along the frontage and are within a 3 mounting heights of frontage luminaires are eligible for this power allowance. The area within three mounting heights may not be counted as part of the outdoor sales lot.

Luminaires qualifying for this allowance must be located in plan view between the principal viewing location and the frontage outdoor sales area.

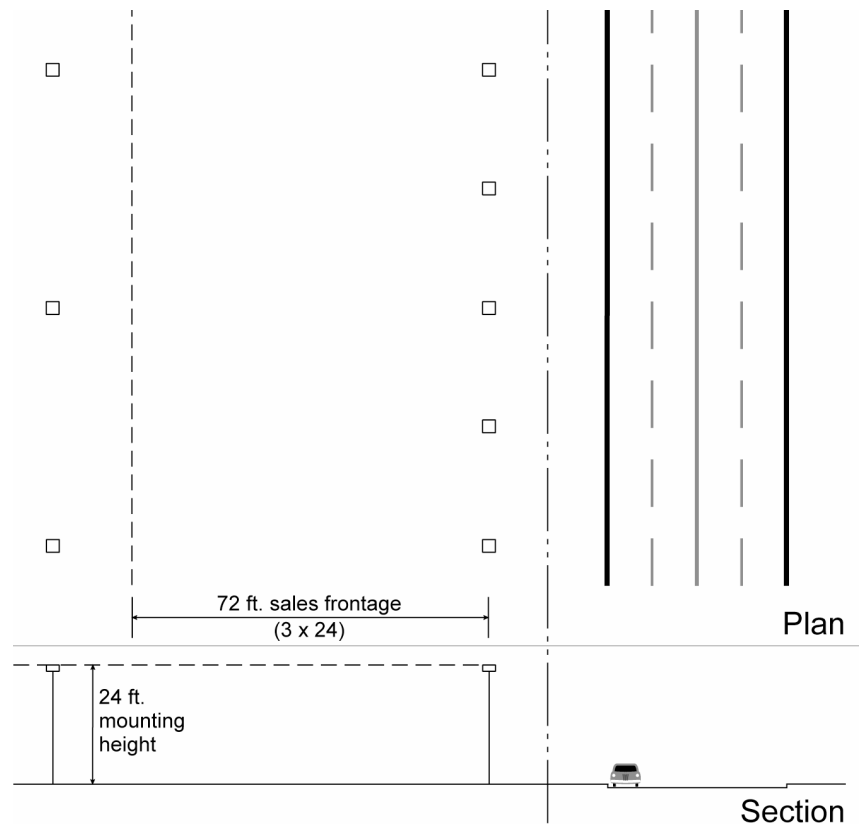
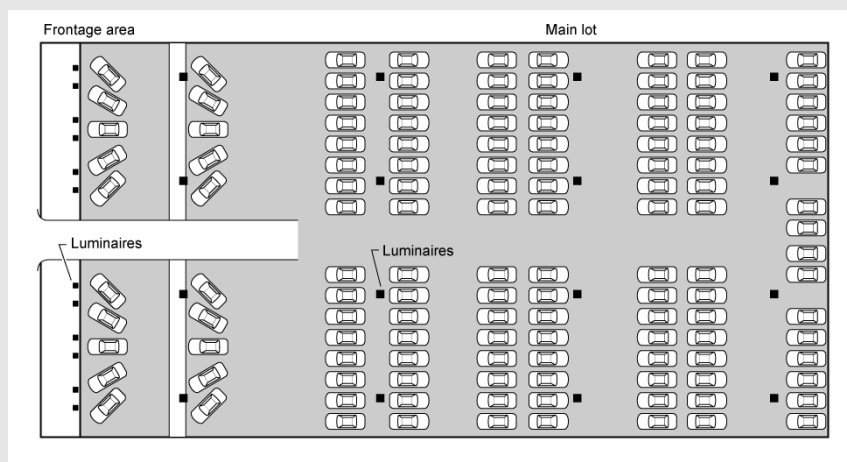


Figure 6-6 – Outdoor Sales Frontage

Example 6-38

Question

A 150ft X 300 ft car lot has 4,000 ft² of walkways, 2,000 ft² of driveways, and the rest is the main sales lot. The frontage is 150 ft long and is equipped with luminaires atop 20 ft high poles. What is the area of the main sales lot and what are the maximum power allowances for various lighting applications, if this car lot is located in Lighting Zone 3?



Answer

The depth of the frontage area is three times the pole height, which is 20 ft x 3 = 60 ft. Therefore the area covered by the frontage luminaires is 60 ft X 150 ft = 9,000 ft².

Total area of the car lot is 150 ft X 300 ft = 45,000 ft². The area of the main sales lot is therefore 45,000 ft² – 4,000 ft² – 2,000 ft² – 9,000 ft² = 30,000 ft². Power allowances for this lot are:

Walkways: 4,000 ft² X 0.17 W/ft² (Standards Table 147-A) = 680 watts

Driveway: 2,000 ft² X 0.15 W/ft² (Standards Table 147-A) = 300 watts

Frontage: 150 ft X 38.5 W/lf (Standards Table 147-B) = 5,778 watts

Main sales lot: 30,000 ft² X 1.25 (Standards Table 147-A) = 37,500 watts

6.6.3 Lighting Vehicle Service Stations

§147(c)2.F.

Vehicle service station is a gasoline or diesel dispensing station. The allowed lighting power for vehicle service stations is the same whether or not they have a canopy. In the instance where there is a canopy, the area is the horizontal projected area of the canopy (or the canopy drip line). In the case where there is no canopy, the area is 500 ft² per double sided fuel dispenser and 250 ft² per single sided fuel dispenser.

The lighting power allowances are listed in Standards Table 147-B.

Luminaires qualifying for this allowance cannot be used to determine allowed lighting power for general site illumination or for other specific lighting applications.



Source: AEC Photographer: Tom Bergstrom

Figure 6-7 – Vehicle Service Station

Example 6-39**Question**

An uncovered vehicle service station in Lighting Zone 2 has six double-sided fuel dispensers. What is the maximum lighting power allowed in this service station?

Answer

500 ft² is allowed per each double-sided fuel dispenser, therefore, the total allowed area is 500 ft²/dispenser x 6 dispensers = 3,000 ft². From Standards Table 147-B, the allowed power density for vehicle service stations with or without canopies in Lighting Zone 2 is 1.0 W/ft². The calculated allowed power is 3,000 ft² X 1.0 W/ft² = 3,000 watts.

6.6.4 Service Station Hardscape Areas

Service station hardscape is paved area around the fuel dispensers that is not part of the area for the fuel dispenser. The lighting power allowances are listed in Standards Table 147-B.

Lighting power used for service station hardscape may not be traded off against other specific lighting applications or against general site illumination. Luminaires qualifying for this allowance cannot be used to determine allowed lighting power for general illumination; for example, this allowance cannot be used for general parking lot illumination.



Source: AEC Photographer: Tom Bergstrom

Figure 6-8 – Service Station Hardscape Areas

Example 6-40

Question

Where does canopy lighting area end and hardscape area start?

Answer

Plan view of the horizontal projection of the canopy on the ground establishes the area for under canopy lighting power calculations. This area also referred to as the “drip line” of the canopy. All hardscape areas beyond drip line are considered to be service station hardscape areas.

Example 6-41**Question**

A 10,000 ft² service station site (exclusive of building) in Lighting Zone 3 has a canopy drip line area of 6,000 ft². What are the outdoor lighting power allowances for this service station?

Answer

From Standards Table 147-B, the lighting power allowance for the fuel dispenser area is 1.25 W/ft², and the lighting power density for the service station hardscape area is 0.40 W/ft². The hardscape area is the total area of the service station site (10,000 ft²), minus the area of the canopy drip line (6,000 ft²), which is 4,000 ft². The lighting power allowances are therefore:

6,000 ft² X 1.25 W/ft² = 7,500 watts for the canopy area

4,000 ft² X 0.40 W/ft² = 1,600 watts for the hardscape areas.

Lighting for each of these areas shall comply on their own. No tradeoffs are permitted between these applications.

6.6.5 Lighting Under Canopies

§147(c)2.D.

A canopy is a permanent structure consisting of a roof and supporting building elements. The space underneath the canopy must be at least partially open, otherwise it is a building. A canopy may be freestanding or attached to surrounding structures. It may also have conditioned space above it, for instance when the first floor of a building is setback.

The lighting power allowance for a canopy depends on its purpose. Service station canopies are treated separately (see the previous section). The two types of canopies addressed in this section are those that are used for sales and those that are not. Non-sales canopies include covered entrances to hotels, office buildings, convention centers and other buildings. Sales canopies specifically cover and protect an outdoor sales area, including garden centers, covered automobile sales lots, and outdoor markets with permanent roofs. The lighting power allowances are listed in Standards Table 147-B.

The area of a canopy is defined as the horizontal projected area, in plan view, directly underneath the canopy. This area is also referred to as the “drip line” of the canopy. Canopy lighting, either sales or non-sales shall comply separately, e.g. trade-offs are not permitted between other specific lighting applications or with general site illumination.

General site lighting or other specific applications lighting, and/or sign lighting that are attached to the sides or top of a canopy, cannot be considered canopy lighting. Every luminaire shall be assigned to only one or the other application. For example, internally illuminated translucent panels on the perimeter of a

canopy are considered Sign lighting, while the lighting underneath the canopy and directed towards the ground is canopy lighting.



Source: AEC Photographer: Tom Bergstrom

Figure 6-9 – Canopy Lighting

Example 6-42

Question

The first floor of an office tower in Lighting Zone 3 is setback 20 ft on the street side. The width of the recessed façade is 150 ft. The primary purpose of the setback (and canopy) is to provide a suitable entrance to the office tower; however, space under the canopy is leased as newsstand, a flower cart and a shoeshine stand. These commercial activities occupy about half of the space beneath the canopy. What is the allowed lighting power?

Answer

The total canopy area is 20 ft x 150 ft or 3,000 ft². The 1,500 ft² used for the flower cart, newsstand and shoeshine stand is considered a sales canopy and the allowance is 1.00 W/ft² or a total of 1,500 watts. The other 1,500 ft² is a non-sales canopy and the allowance is 0.50 W/ft² or a total of 750 watts. Tradeoffs are not permitted between the sales portion and the non-sales portions.

6.6.6 Ornamental Lighting

§147(c)2.C.

Ornamental lighting includes post-top luminaires, lanterns, pendant luminaires, chandeliers, and marquee lighting. The allowances for ornamental lighting are listed in Standards Table 147-B.

The allowance is based on the area of the site external to buildings.

Luminaires used for ornamental lighting shall have a rated wattage, as listed on a permanent factory-installed label, of 100 watts or less.



Source: Ted Walson Photographer

Figure 6-10 – Ornamental Lighting

Example 6-43

Question

Are bollard luminaires considered ornamental lighting?

Answer

No, Ornamental lighting is defined in Standards as post-top luminaires, lanterns, pendant luminaires, chandeliers, and marquee lighting. Bollard luminaires are used for general illumination and ornamental lighting is not used for general illumination.

Example 6-44

Question

An entrance canopy to a hotel has marquee lighting around the perimeter and the outside edge of the canopy. Additional downlights are mounted on the underside of the entry canopy. Is the marquee lighting considered ornamental lighting? How much lighting power is permitted?

Answer

Yes, this is considered ornamental lighting. The allowed power depends on the Lighting Zone and the area of the site, excluding the building footprint. The allowance for Lighting Zone 2 is 0.01 W/ft² of site area. The Lighting Zone 3 allowance is double that or 0.02 W/ft² of site area.

6.6.7 Drive-up Windows

§147(c)2.G.

Drive-up windows are common for fast food restaurants, banks, and parking lot entrances. In order to qualify, a drive-up window must have someone working behind the “window”. Automatic ticket dispensers at parking lots do not count.

The lighting power allowances are listed in Standards Table 147-B.

The area of drive-up windows is the width of the window plus six ft (3 ft on each side of the window) times a maximum distance of 30 ft outward from the window. The distance from the window may not extend beyond the property line or further than 5 ft past the edge of the paving.

Luminaires qualifying for this allowance shall not be used to determine allowed lighting power for general illumination. Drive-up windows shall comply on their

own; tradeoffs are not permitted with other specific lighting applications or with general site illumination. Luminaires qualifying for this allowance cannot be used to determine allowed lighting power for general illumination; for example, this allowance cannot be used for general parking lot illumination.



Source: AEC Photographer: Tom Bergstrom

Figure 6-11 – Drive-up Windows

Example 6-45

Question

A drive-up window in Lighting Zone 2 has width of seven ft. What is the allowed lighting power for this drive-up window?

Answer

The drive-up windows area is the product of the width of the window plus six ft and the distance 30 ft outward from the window. From Standards Table 147-B, the LPD for drive-up windows in Lighting Zone 2 is 0.25 W/ft².

The area is $(7 \text{ ft} + 6 \text{ ft}) \times 30 \text{ ft} = 390 \text{ ft}^2$

The allowed power is $390 \text{ ft}^2 \times 0.25 \text{ w/ft}^2 = 97.5 \text{ watts}$

6.6.8 Guarded Facilities

Guarded facilities, including gated communities, include the entrance driveway, gatehouse, and guardhouse indoor areas that provide access to secure areas controlled by security personnel who stop and may inspect vehicles and vehicle occupants including, identification documentation, vehicle license plates, and vehicle contents.

The guarded facility area includes the guardhouse indoor area plus the product of the entrance width of 25 ft and length of 80 ft, up to the property boundaries. Luminaires qualifying for this allowance shall not be used to determine allowed

lighting power for general illumination; for example, this allowance cannot be used for general parking lot illumination.

The power allowance for guarded facilities are listed in Standards Table 147-B.

Example 6-46

Question

A guard station to the research campus of a defense contractor consists of a heated and cooled guard station of 300 ft². Vehicles enter to the right of the station and exit to the left. What is the power allowance? The guard station is located in Lighting Zone 2.

Answer

Since the guard station is air conditioned, it must meet the requirements of indoor conditioned buildings, including HVAC, building envelope, and lighting requirements. The indoor power allowance is determined from the Area Category Method; Table 146-C, General Commercial and Industrial Work). The allowance for the driveway is based on 2,000 ft² (the default 25 ft x 80 ft area). The allowance for Lighting Zone 2 is 0.40 W/ft² so the total power allowance is 800 watts.

Example 6-47

Question

If in the example above the guardhouse is a 100 square-foot unconditioned shack equipped with only a plug-in radiant heater, what would be the allowed power for this guarded facility?

Answer

§147(c)2.H. states that the area of the guarded facility includes the guardhouse interior area and the driveway. So, the total area is 2,100 W/ft² (2,000 + 100). The allowance for Lighting Zone 2 is 0.40 W/ft² so the total power allowance is 840 watts.

Example 6-48

Question

Is the guarded facility at the entrance to a residential gated community covered by the Standards?

Answer

Yes, residential guarded facilities are covered by the Standards.

6.6.9 Outdoor Dining

Outdoor dining areas are limited to uncovered hardscape areas used to serve and consume food and beverages. If the outdoor dining area is covered, then the allowance is based on a non-sales canopy (see above). The power allowances are listed in Standards Table 147-B.

Outdoor dining areas are hardscape areas used to serve and consume food and beverages. Luminaires qualifying for this allowance shall not be used to determine allowed lighting power for general illumination; for example, this allowance cannot be used for general parking lot illumination.



Source: AEC Photographer: Tom Bergstrom

Figure 6-12 – Outdoor Dining

Example 6-49

Question

An 11,000 ft² outdoor area in Lighting Zone 3 is covered by 3,000 ft² of water features, 4,000 ft² of landscaping, 1,000 ft² of walkways, and 3,000 ft² of outdoor dining. What are the outdoor lighting power allowances for this area?

Answer

Only the walkway and the outdoor dining areas are regulated by the Standards. Therefore, the outdoor lighting power allowances are:

1,000 ft² X 0.17 W/ft² = 170 watts for the walkways, and

3,000 ft² X 0.35 W/ft² = 1,050 watts for the outdoor lighting area

Each of these areas shall comply separately with the Standards. No tradeoffs are permitted.

Table 6-6 – Standards Table 147-B Specific Application LPD Values

Lighting Application	Watts per square feet, unless otherwise noted			
	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Building Facades	Not allowed	0.18	0.35	0.50
Outdoor Sales Frontage (Frontage in linear feet)	Not allowed	22.5 w/lf	38.5 w/lf	55 w/lf
Vehicle Service Station with or without Canopies	0.70	1.15	1.45	2.40
Vehicle Service Station Hardscape	0.05	0.20	0.40	0.60
All Other Sales Canopies	Not allowed	0.70	1.00	1.25
Non-sales canopies	0.12	0.25	0.50	0.70
Ornamental Lighting	Not allowed	0.01	0.02	0.04
Drive Up Windows	0.12	0.25	0.50	0.70
Guarded Facilities	0.19	0.40	0.80	1.10
Outdoor Dining	0.05	0.18	0.35	0.55

6.7 Alterations and Additions for Outdoor Lighting

§149

The Standards apply to alterations and additions to outdoor lighting systems. In general, additions are the same as new construction such as the mandatory measures and compliance with lighting power density requirements. The application of the Standards to alterations depends on the scope of the proposed improvements. In general, alterations to existing outdoor lighting systems that for any lighting application, increase the connected lighting load or replace more than 50% of the luminaires shall meet the requirements.

Some or all mandatory measures may apply to altered components. The mandatory requirements include certification of any new lamps and ballasts that are installed if they are the type regulated by the Appliance Efficiency Regulations. Any new lighting controls must meet minimum performance requirements. In addition, control and circuiting requirements (§130 and §132) may also apply: All outdoor lighting altered components must comply with the requirements of §149(b), and §149(b) 1 I.

Lighting alterations generally refers to replacing the entire luminaire, which includes the housing, lamps, ballasts, and louvers or lenses. Simply replacing the lamps and ballasts in an existing fixture is not considered a lighting alteration. Replacing or installing new wiring (see the following paragraph) represents a lighting alteration and a great opportunity to meet the applicable mandatory requirements as described below.

For lighting alterations purposes, rewiring refers to replacement or installation of new wires that serve the circuit between the switches, relays, branch circuits, other control devices, and rewired luminaire(s). In the case where only the wiring in a circuit that connects the switch and the luminaire(s) is being replaced without any alterations to the luminaire(s), the wiring system itself is considered the altered component and must therefore meet the lighting control requirements.

6.7.1 Outdoor Lighting Additions – Mandatory and Lighting Power Density Requirements

§149(a)1. §130, §132

Mandatory Requirements

Additions to existing outdoor lighting must meet all of the Standards mandatory measures for the added lighting fixtures. The mandatory requirements include certification of any new lamps and ballasts that are installed if they are the type regulated by the Appliance Efficiency Regulations. Any new lighting controls must meet minimum performance requirements. In addition, control and circuiting requirements apply as follows:

- Minimum lamp efficacy or motion sensors for lamps rated over 100 watts.
- Luminaire cutoff requirements for outdoor lighting fixtures that use lamps rated greater than 175 watts.
- Automatic controls to turn off lights when daylight is available.

- Multi-level switching requirements for the added lighting.

Lighting Power Density Requirements

The outdoor lighting additions must also comply with lighting power allowances of §147, Tables 147-A and 147-B. These requirements are the same as new construction discussed earlier in this Chapter.

Example 6-50

Question

I am adding a new 20,000 ft² section to our parking lot. What are the outdoor lighting requirements for the new addition?

Answer

§149(a)1 in the Standards specifies that all additions to existing outdoor lighting systems must comply with prescriptive requirements of §147 and mandatory measures of §130 through §132.

6.7.2 Outdoor Lighting Alterations

§149(b)1.I.

Existing outdoor lighting systems are not required to meet the Standards unless they are altered. However, alterations of existing outdoor lighting systems are subject to requirements similar to those in the Standards for alterations of existing indoor lighting systems. Alterations that increase the connected load, or replace more than 50% of the existing luminaires for each lighting application included in Standards Tables 147-A and 147-B, are required to meet the requirements for newly installed equipment.

6.7.3 Outdoor Lighting Alterations – Mandatory Requirements

When altering lighting components in existing outdoor lighting systems mandatory measures apply to the altered lighting systems. The mandatory requirements include certification of any new lamps and ballasts that are installed if they are the type regulated by the Appliance Efficiency Regulations. Any new lighting controls must meet minimum performance requirements. In addition, control and circuiting requirements (§130 through §132) apply as follows:

- Either minimum lamp efficacy or motion sensors for lamps rated over 100 watts when the entire luminaire is replaced.
- Luminaire cutoff requirements for outdoor lighting fixtures that use lamps rated greater than 175 watts. Replacement of parts of an existing luminaire, including installing new ballasts, lamps, reflector or lens, without replacing the entire luminaire does not trigger luminaire cutoff requirements.
- Automatic controls to turn off lights when daylight is available for luminaires that are altered.
- Multi-level switching requirements if the alteration consists of rewiring.

6.7.4 Outdoor Lighting Alterations – Lighting Power Allowance Requirements

If an alteration involves replacing more than 50% of the lighting fixtures in a given outdoor lighting application or results in an increase in the connected lighting load, compliance with lighting power allowances of Tables 147-A and 147-B are required.

§149(b) 1 I specifies that when more than 50% of luminaires are replaced in a given Lighting Application included in Standards Tables 147-A and 147-B, the alteration requirements apply to that function area only and not the adjacent areas.

When it is necessary to calculate the existing wattage to demonstrate that the alteration does not exceed current lighting power allowances, use the same methodology used for new lighting installations found in Chapter 5.

Example 6-51**Question**

We are replacing 20% of the existing 250-watt fixtures in a parking lot. Does the cutoff requirement apply to the new and existing fixtures?

Answer

§149 (b) in the Standards specifies that all altered components must meet applicable mandatory requirements, including cutoff control for replacements luminaires. Therefore, all new fixtures that are greater than 175 watts must meet the cutoff requirements of the Standards, even if less than 50% of the luminaires on site are replaced. However, the existing fixtures are not required to be upgraded to cutoff.

Example 6-52**Question**

In a service station we are retrofitting all existing light fixtures under the canopy with new lamps, ballasts, reflectors, and lenses, while leaving the fixture housing intact. Does this trigger the alterations requirements for outdoor lighting?

Answer

No, the Standards (§149(b) 1 I), specify that alterations requirements are triggered only when more than 50% of the luminaires are replaced in a given function area, which includes the entire fixture including the internal components and the housing. In this example, since the fixtures are being retrofitted with new components, the alterations requirements of the Standards are not triggered.

Example 6-53**Question**

In a service station we are replacing more than 50% of under canopy fixtures. Does this trigger the alteration requirements for outdoor lighting? Do we need to bring non-canopy lighting such as hardscape lighting up to code as well?

Answer

§149(b) 1 I specifies that when more than 50% of luminaires are replaced in a given Lighting Application included in Standards Tables 147-A and 147-B, the alteration requirements apply to that

function area only. So, in this example, only the under canopy luminaires must meet the requirements of §147. Hardscapes and other outdoor Lighting Applications other than the canopy need not meet these requirements even if they are included in the permit along with the canopy lighting.

Example 6-54

Question

We are adding new light fixtures to the existing lighting systems in a parking lot. Which Standards requirements are triggered by this alteration?

Answer

Since additional load is being added to the parking lot, the entire parking lot must comply with the lighting power density requirements for the given Lighting Zone. However, only the newly installed lighting system must comply with the applicable mandatory requirements, including control requirements and cutoff controls.

Example 6-55

Question

I am going to change the ballasts in my façade lighting system. Will I be required to meet the new outdoor lighting standard for façade lighting?

Answer

No, the replacing of only lamps or ballasts in outdoor lighting systems is not considered an alteration and does not trigger compliance with outdoor lighting Standards. Replacing entire fixtures will trigger mandatory requirements for the altered (replaced) fixtures only. Replacing more than 50% of the lighting fixtures or adding to the connected lighting load for any outdoor lighting application will trigger the lighting power density requirements of the Standards.

6.8 Signs

The sign energy Standards apply to all internally illuminated (cabinet) and externally illuminated signs, whether they are used indoors or outdoors. Examples are internally illuminated and externally illuminated signs, including billboards, off-premise and on-premise signs. They do not apply to unfiltered signs, traffic signs or exit signs. Exit signs must meet the requirements of the *Appliance Efficiency Regulations*. The sign energy Standards are the same throughout the state and are independent of outdoor Lighting Zones.

New signs must meet the requirements of §130 (c) (mandatory requirements) and Luminaire Power requirements, §148. §130 (c), describes how the wattages of various lighting components are added up to calculate the total luminaire wattage. Compliance with this Section is only required for signs that comply under the Component Performance Approach, described below.

§148 provides two alternative ways to comply with the sign Standards. Both alternatives encourage the use of readily available, cost-effective lighting technology.

- Alternate 1 - Component Performance Approach. This option sets the maximum power (watts) per ft² of sign. This approach allows sign

makers' maximum flexibility. It enables companies to introduce, develop and use any promising new lighting technology as long as it meets the power allowance. There are no constraints on the types of lighting equipment that a sign maker can use to comply under this approach, just as long the manufacturer does not exceed the maximum watts allowed for a sign of that size.

- Alternate 2 - Prescriptive Approach. This option uses specific, energy-efficient lighting technologies. This option provides a simple prescriptive approach for using these energy efficient technologies that are already being used by many in the sign industry.

The lighting power used for indoor signs, other than exit signs, does not have to be counted toward the indoor lighting power allowances. Only exit signs that use more than 5 watts per illuminated face are required to be counted toward the indoor lighting power allowance.

The Standards do not apply to unfiltered signs, or to the unfiltered section of an internally or externally illuminated sign. For example, with an internally illuminated cabinet sign with unfiltered incandescent perimeter lights and an unfiltered arrow mounted on top, neither the unfiltered incandescent perimeter lights nor the unfiltered arrow are addressed by the energy Standards, but the internally illuminated section of the cabinet is covered.

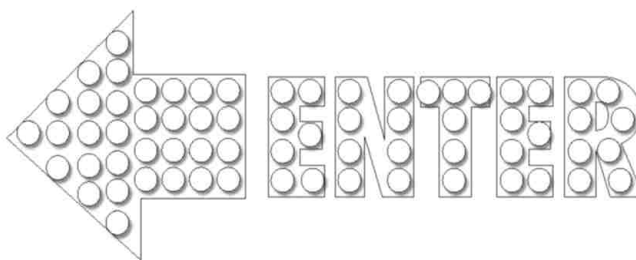


Figure 6-13 – Unfiltered Sign

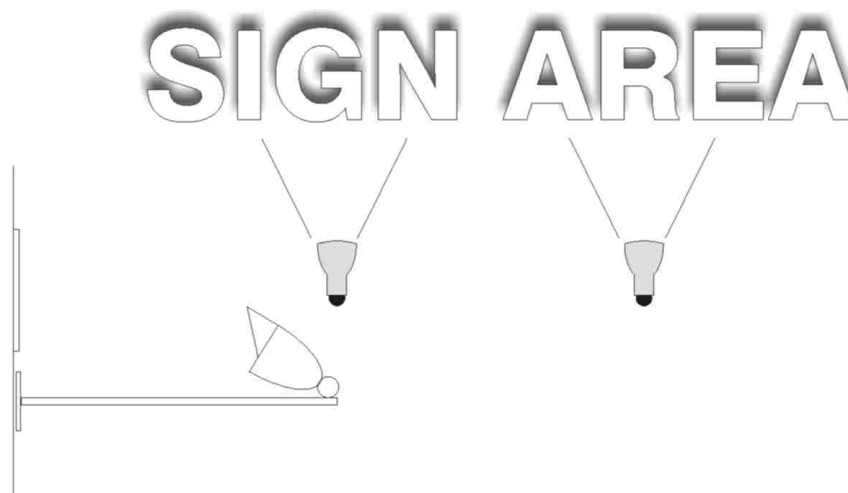
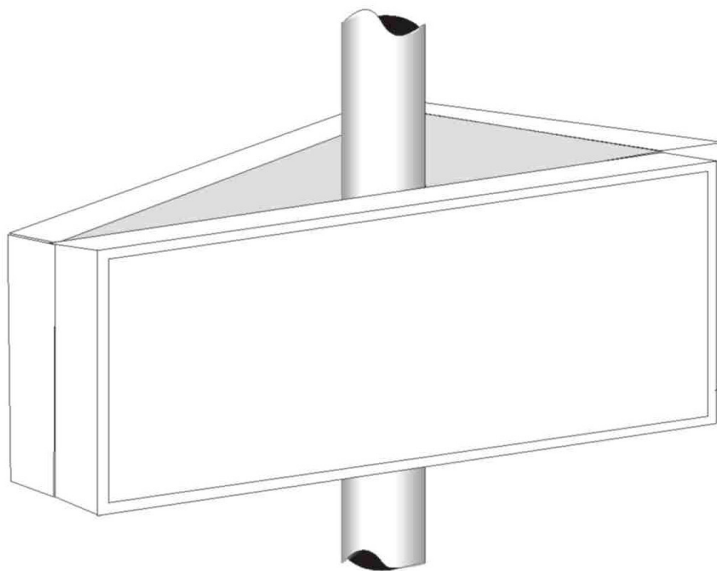


Figure 6-14 – Externally Illuminated Sign Using Flood Lighting

6.8.1 Component Performance Method

The first alternative for internally illuminated signs (component performance method) sets a maximum power allowance of 12 W/ft^2 times the area of the sign face. For double-faced signs, only the area of a single face can be used to determine the allowed lighting power. However, for deep sign cabinets where the lamps are isolated by an opaque divider so that they illuminate only one sign face, or for irregular shaped signs where the faces are not parallel and the lamps are shielded by an opaque divider so that they illuminate only one sign face, then the total area of all of the sign faces can be used to determine the allowed lighting power. See Standards Table 148-A.



*Figure 6-15 – Multi-faced sign
Include Area from Each Face When Separated by Opaque Divider*

For externally illuminated signs the maximum allowed lighting power is 2.3 W/ft^2 times the area that is illuminated without obstruction or interference. One or more fixtures must illuminate the sign area. See Standards Table 148-A.

6.8.2 Prescriptive Approach

The second alternative (prescriptive approach) requires that the sign be illuminated only with one or more of the following light sources (as applicable) or that all light sources be powered by electronic ballasts with a fundamental output frequency not less than 20 kHz:

- High pressure sodium.
- Pulse start and ceramic metal halide.
- Neon.
- Cold cathode.
- Light emitting diodes.

- Barrier coat rare earth phosphor fluorescent lamps (these include most T8 and T5 lamps).
- Compact fluorescent lamps that do not contain a medium base socket (E24/E26).

No other light sources can be used on a sign complying under this option.

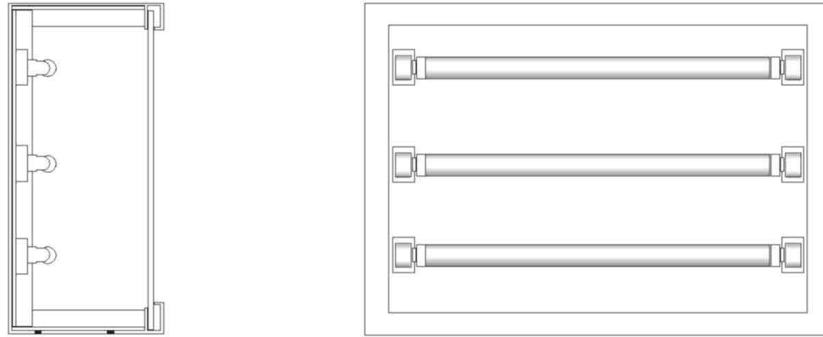


Figure 6-16 – Single-faced Internally Illuminated Cabinet Sign with Fluorescent Lamp and Translucent Face

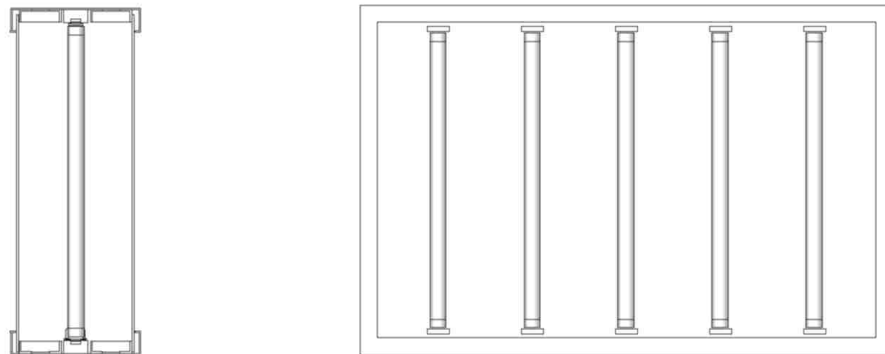


Figure 6-17 – Double-faced Internally Illuminated Cabinet Sign with Fluorescent Lamp and Translucent Faces

Table 6-7 – Sign Compliance Alternatives

			Prescriptive	Component Performance
Includes billboards and on-premise signs	Includes indoor and outdoor signs	Internally Illuminated Signs	12 W/ft²	Electronic ballasts \geq 20 kHz OR, one or more of the following light sources Pulse-start and ceramic metal halide High pressure sodium Neon and cold cathode
		Externally Illuminated Signs	2.3 W/ft²	Light emitting diodes (LED) Barrier coat rare earth phosphor fluorescent lamps (includes most T8 and T5 lamps) Compact fluorescent lamps that do not contain medium based sockets. (E24/E26)

Example 6-56

Question

Can I use neon or cold cathode lights in my sign and comply with the Standards under Alternative 2 (Prescriptive Approach)?

Answer

Yes, neon and cold cathode lights are allowed under the prescriptive approach.

Example 6-57

Question

Do signs inside a theater lobby or other indoor environments need to comply with the sign requirements?

Answer

Yes, all internally and externally illuminated signs whether indoor or outdoor must comply with either the prescriptive or component performance approach.

Example 6-58

Question

My sign is equipped with both hardwired compact fluorescent lamps and incandescent lamps. Can my sign comply under the prescriptive approach?

Answer

No. Since your sign is not exclusively equipped with energy efficient technologies allowed under the prescriptive approach (incandescent sources are not allowed), it therefore must comply under the component performance approach. Your other option is to replace the incandescent sources with an energy efficient option that is permitted under the prescriptive approach, such as LED, pulse start metal halide, or hard-wired CFL sources.

Example 6-59

Question

My sign has two parts, an internally illuminated panel sign equipped with electronic ballasts, and an unfiltered sign on top of the panel sign displaying an illuminated arrow equipped with 20 watt incandescent sources. Does this sign comply with the prescriptive approach?



Answer

Yes, this sign is essentially made up of two different signs; an internally illuminated panel sign equipped with electronic ballast that complies with the prescriptive approach, and an unfiltered sign that is exempt from Standards requirements. Therefore the entire sign complies with the Standards.

Example 6-60

Question

Are signs required to comply with Lighting Zone requirements?

Answer

No. Lighting Zones do not apply in any way to signs. The Sign Energy Efficiency Standards are the same throughout the state; they do not vary with Lighting Zones.

6.8.3 Sign Additions

§149(a)

All new signs regardless of whether they are installed in conjunction with alterations to existing interiors of buildings or alterations to existing outdoor lighting systems must meet the requirements for newly installed equipment. See §149(b)1.G.

6.8.4 Sign Alterations

§149(b)1.J.

Existing indoor and outdoor internally illuminated and externally illuminated signs that are altered as specified by §149(b)1.J are required to meet the requirements of §148 of the Standards. Altered components of existing indoor and outdoor

internally and externally illuminated signs must also meet the requirements of §130 (c), if Component Performance Approach is used for compliance.

The lighting power requirements (either prescriptive or component performance) are triggered by alterations to existing internally or externally illuminated signs when any of the following occurs as result of the alteration as specified in §149(b)1:

- The connected lighting power is increased.
- More than 50% of the ballasts are replaced and rewired.
- The sign is relocated to a different location on the same site or on a different site.

The lighting power requirements are not triggered when just the lamps are replaced, the sign face is replaced or the ballasts are replaced (without rewiring).

These signs must comply with either alternative 1 or alternative 2 of §148. Sign ballast rewiring that triggers the alterations requirements generally involves rewiring from parallel to series or visa versa, or when a ballast(s) is relocated within the same sign requiring relocating the wires. This does not include routine in-place ballast replacements.

Example 6-61

Question

We are replacing 60% of the ballasts in a sign. Must we replace the remaining ballasts in the sign in order to comply with the Standards?

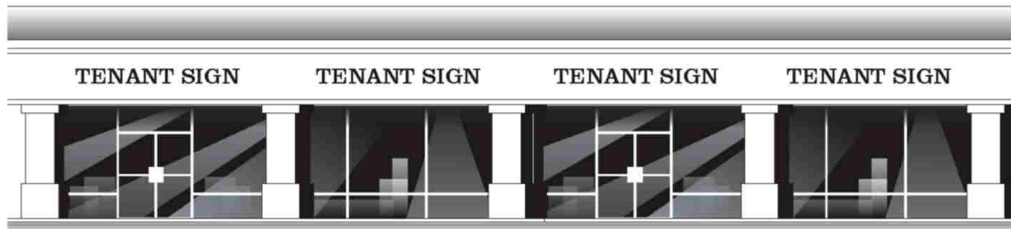
Answer

It depends. If more than 50% of the ballasts are being replaced, and the replacement involves rewiring the ballasts, then the alteration requirements apply to the whole sign. If more than 50% of the ballasts are being replaced during regular maintenance, and the ballasts are not being rewired, then the sign is not required to meet the Standards requirements. However, when existing wiring will allow the direct replacement of a magnetic ballast with a high efficiency high frequency electronic fluorescent ballast, even though Standards do not require the electronic ballast, the sign owner is encouraged to replace the magnetic ballasts with an electronic ballast.

Example 6-62

Question

I have a strip mall full of signs. Must I immediately bring all of these signs into energy efficiency compliance even if I'm not going to alter them?

**Answer**

No, only those signs in which at least 50% of the ballasts are replaced and rewired, or those signs that are moved to a new location (on the same property or different property) must comply with either Alternative 1 or 2 of §148. Also, all newly installed signs must also comply with either Alternative 1 or 2.

6.9 Outdoor and Sign Lighting Plan Check Documents

At the time a building permit application is submitted to the building department, the applicant also submits plans and energy compliance documentation. This section describes the recommended forms and procedures for documenting compliance with the outdoor lighting and sign lighting requirements of the Standards. It does not describe the details of the requirements; these are presented in Section 6.1.3, Summary of Requirements. The following discussion is addressed to the designer preparing construction documents and compliance, and to the building department plan checkers who are examining those documents for compliance with the Standards.

The use of each form is briefly described below, and complete instructions for each form are presented in the following subsections. These forms may be included in the lighting equipment schedules on the plans, provided the information is in a similar format as the suggested form.

OLTG-1-C: Is required on plans for all submittals for outdoor lighting. Part 2 of 2 may be incorporated in schedules on the plans. Either LTG-1-C or OLTG-1-C may be used for signs as follows:

- Use either LTG-1-C or OLTG-1-C if the project consists of indoor or outdoor signs only.
- Use LTG-1-C if the project consists of indoor lighting, and indoor or outdoor signs, but no other outdoor lighting.

- Use OLTG-1-C if the project consists of outdoor lighting, and indoor or outdoor signs, but no other indoor lighting.
- OLTG-2-C: LIGHTING COMPLIANCE SUMMARY– Applicable parts required for ALL outdoor lighting allowances (except for signs).
- OLTG-3-C: AREA CALCULATION WORKSHEETS - Applicable parts required for ALL outdoor area calculations.
- OLTG-4-C: SIGN LIGHTING COMPLIANCE is required for ALL internally and externally illuminated signs, for both indoor and outdoor signs.

6.9.1 OLTG-1-C: Certificate of Compliance

The OLTG-1-C Certificate of Compliance form is in two parts. Both parts must appear on the plans (usually near the front of the electrical drawings). A copy of these forms should also be submitted to the building department along with the rest of the compliance submittal at the time of building permit application. With building department approval, the applicant may use alternative formats of these forms (rather than the official Energy Commission forms), provided the information is the same and in a similar format.

OLTG-1-C Part 1 of 2 Project Description

1. PROJECT NAME is the title of the project, as shown on the plans and known to the building department.
2. DATE is the date of preparation of the compliance submittal package. It should be on or after the date of the plans, and on or before the date of the building permit application.
3. PROJECT ADDRESS is the address of the project as shown on the plans and as known to the building department.
4. PRINCIPAL DESIGNER – OUTDOOR LIGHTING / SIGN LIGHTING is the person responsible for the preparation of the lighting plans, one of two people who sign the STATEMENT OF COMPLIANCE (see below). The person's telephone number is given to facilitate response to any questions that arise.
5. DOCUMENTATION AUTHOR is the person who prepared the energy compliance documentation. This may or may not be the principal designer (it may be a person specializing in energy standards compliance work). This person is not subject to the Business and Profession's Code. The person's telephone number is given to facilitate response to any questions that arise.
6. ENFORCEMENT AGENCY USE is reserved for building department record keeping purposes.
7. DATE OF PLANS is the last revision date of the plans. If the plans are revised after this date, it may be necessary to resubmit the compliance documentation to reflect the altered design. The building department will determine whether or not the revisions require this.

8. OUTDOOR LIGHTING ZONE of the building according to §10-114. This information is not required if the project consists solely of sign lighting. Refer to Section 6.3.
9. FUNCTION TYPE is specified because there are special requirements for outdoor lighting and for indoor or outdoor signs.
10. PHASE OF CONSTRUCTION indicates the status of the outdoor lighting or sign lighting project described in the documents.
11. NEW CONSTRUCTION should be checked for all new outdoor lighting and sign lighting projects. See Section 6.1.3.
12. ADDITION should be checked for an addition which is not treated as a stand-alone outdoor lighting or sign lighting project, which uses are described in Section 6.6.1, Outdoor Lighting Additions.
13. ALTERATION should be checked for alterations to existing outdoor lighting or sign lighting systems. See Section 6.7.2.

Statement of Compliance

The Statement of Compliance is signed by the person responsible for preparation of the plans for the outdoor lighting or sign lighting project. This person is also responsible for the energy compliance documentation, even if the actual work is delegated to someone else (the Documentation Author described above). It is necessary that the compliance documentation be consistent with the plans. The Business and Professions Code governs who is qualified to prepare plans, and therefore to sign this statement; check the appropriate box that describes the signer's eligibility.

Applicable sections from the Business and Professions Code (based on the edition in effect as of August 2000), referenced on the Certificate of Compliance, are provided below:

5537. (a) *This chapter does not prohibit any person from preparing plans, drawings, or specifications for any of the following:*

(1) *Single-family dwellings of woodframe construction not more than two stories and basement in height.*

(2) *Multiple dwellings containing no more than four dwelling units of woodframe construction not more than two stories and basement in height. However, this paragraph shall not be construed as allowing an unlicensed person to design multiple clusters of up to four dwelling units each to form apartment or condominium complexes where the total exceeds four units on any lawfully divided lot.*

(3) *Garages or other structures appurtenant to buildings described under subdivision (a), of woodframe construction not more than two stories and basement in height.*

(4) *Agricultural and ranch buildings of woodframe construction, unless the building official having jurisdiction deems that an undue risk to the public health, safety, or welfare is involved.*

(b) *If any portion of any structure exempted by this section deviates from substantial compliance with conventional framing requirements for woodframe*

construction found in the most recent edition of Title 24 of the California Code of Regulations or tables of limitation for woodframe construction, as defined by the applicable building code duly adopted by the local jurisdiction or the state, the building official having jurisdiction shall require the preparation of plans, drawings, specifications, or calculations for that portion by, or under the responsible control of, a licensed architect or registered engineer. The documents for that portion shall bear the stamp and signature of the licensee who is responsible for their preparation. Substantial compliance for purposes of this section is not intended to restrict the ability of the building officials to approve plans pursuant to existing law and is only intended to clarify the intent of Chapter 405 of the Statutes of 1985.

5537.2. *This chapter shall not be construed as authorizing a licensed contractor to perform design services beyond those described in Section 5537 or in Chapter 9 (commencing with Section 7000), unless those services are performed by or under the direct supervision of a person licensed to practice architecture under this chapter, or a professional or civil engineer licensed pursuant to Chapter 7 (commencing with Section 6700) of Division 3, insofar as the professional or civil engineer practices the profession for which he or she is registered under that chapter.*

However, this section does not prohibit a licensed contractor from performing any of the services permitted by Chapter 9 (commencing with Section 7000) of Division 3 within the classification for which the license is issued. Those services may include the preparation of shop and field drawings for work which he or she has contracted or offered to perform, and designing systems and facilities which are necessary to the completion of contracting services which he or she has contracted or offered to perform.

However, a licensed contractor may not use the title "architect," unless he or she holds a license as required in this chapter.

5538. *This chapter does not prohibit any person from furnishing either alone or with contractors, if required by Chapter 9 (commencing with Section 7000) of Division 3, labor and materials, with or without plans, drawings, specifications, instruments of service, or other data covering such labor and materials to be used for any of the following:*

(a) For nonstructural or nonseismic storefronts, interior alterations or additions, fixtures, cabinetwork, furniture, or other appliances or equipment.

(b) For any nonstructural or nonseismic work necessary to provide for their installation.

(c) For any nonstructural or nonseismic alterations or additions to any building necessary to or attendant upon the installation of those storefronts, interior alterations or additions, fixtures, cabinetwork, furniture, appliances, or equipment, provided those alterations do not change or affect the structural system or safety of the building.

6737.1. *(a) This chapter does not prohibit any person from preparing plans, drawings, or specifications for any of the following:*

(1) Single-family dwellings of woodframe construction not more than two stories and basement in height.

(2) Multiple dwellings containing no more than four dwelling units of woodframe construction not more than two stories and basement in height. However, this paragraph shall not be construed as allowing an unlicensed person to design multiple clusters of up to four dwelling units each to form apartment or condominium complexes where the total exceeds four units on any lawfully divided lot.

(3) Garages or other structures appurtenant to buildings described under subdivision (a), of woodframe construction not more than two stories and basement in height.

(4) Agricultural and ranch buildings of woodframe construction, unless the building official having jurisdiction deems that an undue risk to the public health, safety or welfare is involved.

(b) If any portion of any structure exempted by this section deviates from substantial compliance with conventional framing requirements for woodframe construction found in the most recent edition of Title 24 of the California Administrative Code or tables of limitation for woodframe construction, as defined by the applicable building code duly adopted by the local jurisdiction or the state, the building official having jurisdiction shall require the preparation of plans, drawings, specifications, or calculations for that portion by, or under the direct supervision of, a licensed architect or registered engineer. The documents for that portion shall bear the stamp and signature of the licensee who is responsible for their preparation.

6737.3. *A contractor, licensed under Chapter 9 (commencing with Section 7000) of Division 3, is exempt from the provisions of this chapter relating to the practice of electrical or mechanical engineering so long as the services he or she holds himself or herself out as able to perform or does perform, which services are subject to the provisions of this chapter, are performed by, or under the responsible supervision of a registered electrical or mechanical engineer insofar as the electrical or mechanical engineer practices the branch of engineering for which he or she is registered.*

This section shall not prohibit a licensed contractor, while engaged in the business of contracting for the installation of electrical or mechanical systems or facilities, from designing those systems or facilities in accordance with applicable construction codes and standards for work to be performed and supervised by that contractor within the classification for which his or her license is issued, or from preparing electrical or mechanical shop or field drawings for work which he or she has contracted to perform. Nothing in this section is intended to imply that a licensed contractor may design work that is to be installed by another person.

Lighting Mandatory Measures

This portion requests the location of notes clarifying the inclusion of the mandatory requirements. Notes should be included on the plans to demonstrate compliance with mandatory requirements of the Standards.

Following are prototype examples of the notes that should be rewritten to actual conditions. A note for each of the items listed should be included, even if the note states “not applicable”.

Determining installed lighting power:

- Installed lighting power has been determined in accordance with §130(c)1.

Controls for inefficient lighting systems:

- All outdoor luminaires with lamps rated over 100 watts must either: have a lamp efficacy of at least 60 lumens per watt; or be controlled by a motion sensor (§132(a)).

Outdoor luminaire cutoff:

- Outdoor luminaires that use lamps rated greater than 175 watts (§132 (b)) in the hardscape areas, parking lots, building entrances, canopies and all outdoor sales areas will be required to be designated cutoff in a photometric test report that includes any tilt or other non-level mounting conditions.

Controls to turn off the lights during the day:

- All permanently installed outdoor lighting must be controlled by a photoelectric switch or astronomical time switch that automatically turns off the outdoor lighting when daylight is available (§132 (c)1).

Controls to provide the option to turn off a portion of the lights:

- For lighting of building facades, parking lots, garages, sales and non-sales canopies, and all outdoor sales areas, automatic controls are required to provide the owner with the ability to turn off the lighting or to reduce the lighting power by at least 50% but not exceeding 80% when the lighting is not needed (§132(c)2).

The above notes are only examples of wording. Each mandatory measure that requires a separate note should be listed on the plans.

To verify certification, use one of the following options:

- The Energy Hotline (see above) can verify certification of appliances not found in the above directories.
- The Energy Commission's Web Site includes listings of energy efficient appliances for several appliance types. The web site address is <http://www.energy.ca.gov/efficiency/appliances/>.
- The complete appliance databases can be downloaded from the Energy Commission's Internet FTP site (<ftp://sna.com/pub/users/efftech/appliances>). This requires database software (spreadsheet programs cannot handle some of the larger files). To use the data, a user must download the database file (or files), download a brand file and a manufacturer file and then decompress these files. Then download a description file that provides details on what is contained in each of the data fields. With

these files, and using database software, the data can be sorted and manipulated.

Documenting the mandatory measures on the plans is accomplished through a confirmation statement, notes and actual equipment location as identified on the plans. The plans should clearly indicate the location and type of all mandatory control devices; such as motion sensors, photocontrols, astronomical time switches, and automatic time switches.

OLTG-1-C Part 2 of 2

Part 2 of OLTG-1-C documents that mandatory measures, lighting schedules, and automatic controls are in compliance with Standards.

The first section consists of checklists indicating compliance with outdoor lighting power allowance requirements or sign lighting compliance. There are two boxes on each line, one checkbox for indicating that a particular compliance form was filled out, and the other checkbox for indicating the compliance form is “Not Applicable” to the project. One box should be checked for each line.

The second section consists of checklists indicating compliance with outdoor lighting mandatory measures. There are two boxes on each line, one checkbox for indicating compliance with a particular mandatory section in Standards, and the other checkbox for indicating this mandatory measure is “Not Applicable” to the project. One box should be checked for each line.

The third section should be used to describe the lighting control devices designed to be installed.

The information on this form may, with the approval of the building official, be incorporated into equipment schedules on the plans, rather than presented on the OLTG-1-C Part 2 form. If this is done, however, the same information should be included in one schedule in a format similar to the Energy Commission form.

6.9.2 OLTG-2-C

Form OLTG-2-C (Lighting Compliance Summary) shall be completed and submitted for general site illumination (part 1 of 4); for local ordinance lighting levels or special security requirement multipliers (part 2 of 4); for specific applications other than vehicle service station without canopies (part 3 of 4); and, for vehicle service stations without canopies (part 4 of 4). These forms are not required to be on the plans (they may be submitted separately in the energy compliance package) the designer may include them in the lighting equipment schedules provided the information is in a similar format.

OLTG-3-C (Area Calculation Worksheets) must be used to calculate the areas of each application, which is then entered into the appropriate column on OLTG-2-C.

Lighting Compliance Summary for General Site Illumination

OLTG-2-C Part 1 of 4 is for lighting power allowances for general site illumination (Standards Table 147-A). Tradeoffs are normally allowed between general site illumination applications. However, tradeoffs are not allowed for general site illumination applications when using Exception 1 or Exception 2 to

§147 (c)1 B. [Use OLTG-2-C Part 2 of 4 when applying Exception 1 or Exception 2 to §147 (c)1 B]. The TOTAL INSTALLED WATTS (bottom of COLUMN O) cannot be greater than the TOTAL ALLOTTED WATTS (bottom of COLUMN D).

1. COLUMN A - List the lighting application category from Standards Table 147-A.
2. COLUMN B - List the lineal feet (lf), or square feet (ft²) of the area as applicable. Use the appropriate OLTG-3-C (Area Calculation Worksheets) to calculate illuminated lengths or areas to enter into this column. Each portion of all illuminated areas shall be assigned only one lighting application, and the applications shall be consistent with the actual use of the area.
3. COLUMN C - List the allotted lighting power density (LPD) in watts per lineal foot (lf) or watts per square foot (ft²) from Standards Table 147-A. The LPD must correspond with the lighting zone (LZ) checked in OLTG-1-C.
4. COLUMN D - Calculate the allotted watts by multiplying COLUMNS B x C.
5. COLUMN E is the code for each luminaire type as it is described by name, type or symbol on the plans.
6. COLUMN F - Luminaire description is the type of lighting fixture (shoe box, cobra head, vertical/horizontal burn, etc).
7. COLUMN G - Cutoff designation is the IESNA cutoff designation, such as full-cutoff, cutoff, semi-cutoff and non-cutoff.
8. COLUMN H - Type lamp is the type of lamp (incandescent, fluorescent or high-intensity discharge, LED, etc.).
9. COLUMN I - Number of lamps per luminaire is the number of lamps in each luminaire or fixture.
10. COLUMN J - Watts per lamp is the listed watts per lamp.
11. COLUMN K - Number ballasts per luminaire is the number of ballasts in each luminaire or fixture.
12. COLUMN L - Watts per luminaire are to be determined in accordance with §130 (c). An alternate method to determine luminaire power for pin-based fluorescent and high intensity discharge (HID) lighting systems is to use the watts that are listed in ACM Manual Appendix NB. However, luminaires with screw-base sockets (other than HID fixtures manufactured with hard-wired HID ballasts), and lighting systems which allow the addition or relocation of luminaires without altering the wiring of the system must be determined in accordance with §130 (c).
13. COLUMN M - Check (☞) if Energy Commission default indicates that the luminaire wattages used for pin-based fluorescent or for high intensity discharge lighting systems are from the Energy Commission defaults in ACM Manual Appendix NB.
14. COLUMN N - Number of luminaires is the number of luminaires or fixtures used to illuminate this lighting application

15. COLUMN O - Calculate installed watts. Multiply the watts per luminaire by the number of luminaires (L x N) and enter the total.

Lighting Compliance Summary for Local Ordinance or Special Security Requirements

OLTG-2-C Part 2 of 4 is to be used for Exception 1 to §147(c)1.B when specific light levels are required by law through a local ordinance and the lighting power densities specified in Standards Table 147-C are used, and for Exception 2 to §147(c)1.B. when special security requirement multipliers from Standards Table 147-D are used. Tradeoffs are NOT allowed between these applications. For each row, the installed watts (COLUMN O) cannot be greater than the allotted watts (COLUMN D).

1. COLUMN A - List the lighting application category from Standards Table 147-A.
2. COLUMN B - List the lineal feet (lf), or square feet (ft²) of the area as applicable. Use the appropriate OLTG-3-C (Area Calculation Worksheets) to calculate the illuminated area. Each portion of all illuminated areas shall be assigned only one lighting application, and the applications shall be consistent with the actual use of the area.
3. COLUMN C - List the allotted lighting power density (LPD) in watts per lineal foot (lf) or watts per square foot (ft²) from Standards Table 147-A. The LPD must correspond with the Lighting Zone (LZ) checked in OLTG-1-C.
4. COLUMN D Either list the multiplier for special security requirements from Standards Table 147-D, if applicable, or write, "147-C" to indicate that the alternate power allowances from Standards Table 147-C are being used. The multipliers can be used only when Exception 2 to §147(c)1.B. applies. Standards Table 147-C can be used only when there is a law through a local ordinance requiring specific lighting levels.
5. COLUMN E - Calculate the allotted watts. When using special security multipliers from Standards Table 147-D multiply columns (B x C x D). When using lighting power allowances from Standards Table 147-C multiply columns (B x C).
6. COLUMN F - The code for each luminaire type is described by its name, type or symbol as shown on the plans.
7. COLUMN G - Luminaire description is the type of lighting fixture (shoe box, cobra head, vertical/horizontal burn, etc).
8. COLUMN H - Cutoff designation is the IESNA cutoff designation, such as full cutoff, cutoff, semi cutoff and non cutoff.
9. COLUMN I - Type lamp is the type of lamp (incandescent, fluorescent or high-intensity discharge, LED, etc.).
10. COLUMN J - Number of lamps per luminaire is the number of lamps in each luminaire or fixture.
11. COLUMN K - Watts per lamp is the listed watts per lamp.
12. COLUMN L - Number ballasts per luminaire is the number of ballasts in each luminaire or fixture.

13. COLUMN M - Watts per luminaire are to be determined in accordance with §130 (c). An alternate method to determine luminaire power for pin-based fluorescent and high intensity discharge (HID) lighting systems is to use the watts that are listed in ACM Manual Appendix NB. However, luminaires with screw-base sockets (other than HID fixtures manufactured with hard-wired HID ballasts), and lighting systems which allow the addition or relocation of luminaires without altering the wiring of the system must be determined in accordance with §130 (c).
14. COLUMN N - Check (➡) if Energy Commission default indicates that the luminaire wattages used for pin-based fluorescent or for high intensity discharge lighting systems are from the Energy Commission defaults in ACM Manual Appendix NB.
15. COLUMN O - The number of luminaires is the number of luminaires or fixtures used to illuminate this general lighting application.
16. COLUMN P - Installed watts multiply the watts per luminaire by the number of luminaires (M x O) and enter the total. For each line, the installed watts (COLUMN P) cannot be greater than the Allotted watts (COLUMN E).

Installed Lighting Power Allowance for Specific Applications

OLTG-2-C Part 3 of 4 is for specific applications (Standards Table 147-B), other than vehicle service station without canopies. Tradeoffs are not allowed between specific applications.

1. COLUMN A - List the lighting application category from Standards Table 147-B.
2. COLUMN B - List the lineal feet (lf), or square feet (ft²) of the area as applicable. Use the appropriate OLTG-3-C (Area Calculation Worksheets) to calculate the illuminated area. Each portion of all illuminated areas shall be assigned only one lighting application, and the applications shall be consistent with the actual use of the area.
3. COLUMN C - List the allotted lighting power density (LPD) in watts per lineal foot or watts per square foot from Standards Table 147-B. The LPD must correspond with the Lighting Zone (LZ) checked in OLTG-1-C.
4. COLUMN D - Calculate the allotted watts by multiplying columns (B x C).
5. COLUMN E - The code for each luminaire type is described by name, type or symbol as shown on the plans.
6. COLUMN F - Luminaire description lists the type of lighting fixture (shoe box, cobra head, vertical/horizontal burn, etc.).
7. COLUMN G - Cutoff designation is the IESNA cutoff designation, such as full-cutoff, cutoff, semi-cutoff and non-cutoff.
8. COLUMN H - Type lamp is the type of lamp (incandescent, fluorescent or high-intensity discharge, LED, etc.).
9. COLUMN I - Number of lamps per luminaire is the number of lamps in each luminaire or fixture.

10. COLUMN J - Watts per lamp is the listed watts per lamp.
11. COLUMN K - Number ballasts per luminaire is the number of ballasts in each luminaire or fixture.
12. COLUMN L - Watts per luminaire are to be determined in accordance with §130(c). An alternate method to determine luminaire power for pin-based fluorescent and high intensity discharge (HID) lighting systems is to use the watts that are listed in ACM Manual Appendix NB. However, luminaires with screw-base sockets (other than HID fixtures manufactured with hard-wired HID ballasts), and lighting systems which allow the addition or relocation of luminaires without altering the wiring of the system must be determined in accordance with §130(c).
13. COLUMN M - Check (☞) if Energy Commission default indicates that the luminaire wattages used for pin-based fluorescent or for high intensity discharge lighting systems are from the Energy Commission defaults in ACM Manual Appendix NB.
14. COLUMN N - Number of luminaires is the number of luminaires or fixtures used to illuminate this specific lighting application.
15. COLUMN O - To find design watts, multiply the watts per luminaire by number of luminaires (L x N).
16. COLUMN P - The allowed watts for each line is the smaller of allotted watts (COLUMN D) or design watts (COLUMN O).

Installed Lighting Power Allowance for Vehicle Service Stations without Canopies

OLTG-2-C Part 4 of 4 is for vehicle service station without canopies. Tradeoffs are not allowed between specific applications.

1. COLUMN A - List "single" for single sided fuel dispensers, and "double" for double sided fuel dispensers.
2. COLUMN B - List "250" square feet for single sided fuel dispensers, and "500" square feet for double sided fuel dispensers. Each portion of all illuminated areas shall be assigned only one lighting application, and the applications shall be consistent with the actual use of the area.
3. COLUMN C - List the allotted lighting power density (LPD) in watts per square foot from Standards Table 147-B. The LPD must correspond with the Lighting Zone (LZ) checked in OLTG-1-C.
4. COLUMN D - Calculate the allotted watts by multiplying COLUMNS (B x C).
5. COLUMN E - The code for each luminaire type is described by name, type or symbol as shown on the plans.
6. COLUMN F - Luminaire description lists the type of lighting fixture (shoe box, cobra head, vertical/horizontal burn, etc).
7. COLUMN G - Cutoff designation is the IESNA cutoff designation, such as full-cutoff, cutoff, semi-cutoff and non-cutoff.
8. COLUMN H - Type lamp is the type of lamp (incandescent, fluorescent or high-intensity discharge, LED, etc.).

9. COLUMN I - Number of lamps per luminaire is the number of lamps in each luminaire or fixture.
10. COLUMN J - Watts per lamp is the listed watts per lamp.
11. COLUMN K - Number ballasts per luminaire is the number of ballasts in each luminaire or fixture.
12. COLUMN L - Watts per luminaire are to be determined in accordance with §130(c). An alternate method to determine luminaire power for pin-based fluorescent and high intensity discharge (HID) lighting systems is to use the watts that are listed in ACM Manual Appendix NB. However, luminaires with screw-base sockets (other than HID fixtures manufactured with hard-wired HID ballasts), and lighting systems which allow the addition or relocation of luminaires without altering the wiring of the system must be determined in accordance with §130(c).
13. COLUMN M - Check (☛) if Energy Commission default indicates that the luminaire wattages used for pin-based fluorescent or for high intensity discharge lighting systems are from the Energy Commission defaults in ACM Manual Appendix NB.
14. COLUMN N - Number of luminaires is the number of luminaires or fixtures used to illuminate this specific lighting application.
15. COLUMN O - To find design watts, multiply the watts per luminaire by the number of luminaires ($L \times N$).
16. COLUMN P - The allowed watts is the smaller of allotted watts (COLUMN D) or design watts (COLUMN O).

6.9.3 OLTG 3-C Forms

OLTG-3-C Forms shall be used to calculate illuminated areas. This information is useful for two purposes:

- To find the illuminated length or area of each application to enter into the appropriate columns in the OLTG-2-C forms, and so that the allowed power for each application can be calculated.
- To verify that overlapping areas of another application or luminaire are not double counted.

Illuminated Area Worksheet for Hardscape, Method (i)

OLTG-3-C Part 1 of 5 shall be used to calculate the square feet of illuminated area for hardscape using method (i). The allowed area for method (i) is based upon square footage in Standards Table 147-A. There are two parts to this form:

- A. Hardscape for automotive vehicular use, including parking lots, driveways, and site roads.
- B. Hardscape for pedestrian use, including plazas, sidewalks, walkways, and bikeways.

1. COLUMN A - List the lighting application category from Standards Table 147-A (i.e. parking lot, driveway, site road, plaza, sidewalk, walkway, bikeway, etc.).
2. COLUMN B - To calculate the illuminated area, first identify the perimeter of the area, in plan view. Each edge of the perimeter will be the smaller of the edge of the paved area, the property boundary, or a distance of three times the MOUNTING height from the closest luminaire. For hardscape for VEHICULAR use, you may add 5 feet to the perimeter of adjacent unpaved land, and include planters and landscaped areas less than 10-feet wide that are enclosed by hardscape on at least 3 sides. For hardscape for PEDESTRIAN use you may add 5 feet of unpaved land on either side of the path of travel, and include all contiguous paved area before including adjacent grounds.
3. COLUMN C - Any areas within the bounds of the application that have poles spaced greater than 6 times the mounting height shall be considered not illuminated. If there are any such areas, list the total square footage here. Leave this column blank if there are no such areas.
4. COLUMN D - Each portion of all illuminated areas can be assigned only one application, and the application must be consistent with the actual used of that area. Enter in this column the square feet of any areas within the bounds of this application that have been assigned to another application. Leave this column blank if there are no such areas.
5. COLUMN E - If a building lies within the bounds of the paved area that was identified in COLUMN A, subtract the square feet of the footprint of that building and enter in this column. Leave this column blank if there are no such areas.
6. COLUMN F - If a sign or other obstruction blocks light to a portion of the illuminated area that was identified in COLUMN A, then enter that square footage here. Leave this column blank if there are no such areas.
7. COLUMN G - If there are any entries in COLUMNS C through F, add them up and list the total in this column.
8. COLUMN H - Subtract G from B to find the illuminated area. This is the illuminated area to be used in OLTG-2-C. If this area overlaps any other illuminated application areas, then subtract any overlapping areas from the other application.

Illuminated Area Worksheet for Hardscape, Method (ii) and Building Entrances

OLTG-3-C Part 2 of 5 shall be used to calculate the area for hardscape method (ii) and for building entrances without canopies in Standards Table 147-A. There are two parts to this form:

- A. Hardscape method (ii) is used to calculate the linear footage option from Standards Table 147-A.
1. COLUMN A - List the lighting application category from Standards Table 147-A using hardscape method (ii) [driveway, site road, sidewalk, walkway, bikeway].

2. COLUMN B - List the length of the 25 foot wide path incorporating as much of the paved area as possible. If this path overlaps any other illuminated application areas, then subtract the overlapping area from the other application.
 - B. Building entrances without canopies is used to calculate the area listed in Standards Table 147-A.
3. COLUMN A - List the width of the window plus 3 feet.
4. COLUMN B - List the smaller of 18 feet, or the distance to the edge of the property line.
5. COLUMN B - Multiply the width in COLUMN A by the distance in B. This is the illuminated area to be used in OLTG-2-C. If this area overlaps any other illuminated application areas, then subtract any overlapping areas from the other application.

Illuminated Area Worksheet for Outdoor Sales Lot and Building Facade

OLTG-3-C Part 3 of 5 shall be used to calculate the area for outdoor sales lots in Standards Table 147-A, the length of sales frontage in Standards Table 147-B, and building façade area in Standards Table 147-B. There are two parts to this form:

- A. Outdoor Sales Lot Frontage and Sales Lot Area
1. COLUMN A - To calculate the gross illuminated area (square feet) first identify the perimeter of the area, in plan view. Each edge of the perimeter will be the smaller of the edge of the paved area, the property boundary, or a distance of 3-times the MOUNTING height from the closest luminaire. (In cases where only a portion of a paved area is illuminated, then the illuminated area extends into the non-illuminated paved area by a distance of 3 times the mounting height of the luminaire closest to the non-illuminated area. Any paved areas beyond 3 times the luminaire mounting height are considered non-illuminated).
 2. COLUMN B - If an allotment for outdoor sales frontage in Standards Table 147-B is used then the area that is allotted to the sales frontage must be subtracted from the remaining outdoor sales area. List the mounting height of the luminaires that qualify for the sales frontage allotment in this column.
 3. COLUMN C - Multiply the mounting height in COLUMN B by 3 and enter in this column. This identifies the depth of the area allotted to sales frontage that must be subtracted from the sales area.
 4. COLUMN D - If the sales frontage luminaires are mounted beyond the edge of the sales lot (i.e. mounted in an unpaved area between the road and the sales lot) then that unpaved area is not required to be subtracted from the sales lot area. Subtract the distance (in plan view) from the luminaire mounting to the front edge of the sales lot and enter in this column.
 5. COLUMN E - Enter the length (linear feet) of sales lot frontage. This is the sales lot frontage number that can be used in OLTG-2-C. Measured in plan view, only the illuminated section of outdoor sales frontage areas

that are immediately adjacent to the principal viewing location and unobstructed viewing length, and are within 3 mounting heights of the frontage can be used. Luminaires qualifying for this allowance shall be located in plan view between the principal viewing location and the frontage outdoor sales.

6. COLUMN F is the sales frontage area that must be subtracted from the outdoor sales lot. Subtract COLUMN D (if applicable) from COLUMN C, and multiply that number by COLUMN E [COLUMN (C - D) x E]. This is the area of the sales lot that was allotted to sales frontage.
7. COLUMN G - Enter any areas that have been allotted to another application.
8. COLUMN H - Subtract the sales frontage area and the overlapping areas of another application from the gross illuminated area (COLUMNS A – F – G). This is the illuminated area to be used in OLTG-2-C. If this area overlaps any other illuminated application areas, then subtract any overlapping areas from the other application.

- **B. Building Façade Area**

1. COLUMN A -Identify the name and orientation of the façade plan.
2. COLUMN B -List the length (linear feet) of the facade
3. COLUMN C -List the height (linear feet) of the facade
4. COLUMN D -Multiply the length times the height (COLUMNS B x C). This is the gross façade area.
5. COLUMN E -Façade areas that are covered by signs must be subtracted from the gross façade area. List the total square footage of signage on this façade in this column.
6. COLUMN F -Façade areas for which illumination is obstructed by objects must be subtracted from the gross façade area. If obstructed façade area was included in COLUMN D, then list the obstructed square footage in this column.
7. COLUMN G -Add sign area and obstructed area (COLUMNS E + F) and list in this column.
8. COLUMN H -The net façade area is the gross area minus subtracted areas (COLUMNS D – G). This is the façade area that can be used in OLTG-2-C to calculate allowed lighting power.

Illuminated Area Worksheet for Specific Areas

OLTG-3-C Part 4 of 5 shall be used to calculate the square feet of illuminated area for ornamental, canopy, vehicle service station hardscape, and outdoor dining areas from Standards Table 147-B.

1. COLUMN A -List the lighting application category from Standards Table 147-B.
2. COLUMN B -To calculate the illuminated area first identify the perimeter of the area, in plan view. Each edge of the perimeter will be the smaller

of the edge of the paved area, the property boundary, or a distance of 3-times the MOUNTING height from the closest luminaire.

3. COLUMN C - Any areas within the bounds of the application that have poles spaced greater than 6 times the mounting height shall be considered not illuminated. If there are any such areas, list the total square footage here. Leave this column blank if there are no such areas.
4. COLUMN D - Each portion of all illuminated areas can be assigned only one application, and the application must be consistent with the actual used of that area. Enter in this column the square feet of any areas within the bounds of this application that have been assigned to another application. Leave this column blank if there are no such areas.
5. COLUMN E - If a sign, building, or other obstruction blocks light to a portion of the illuminated area that was identified in column A, then include that square footage here. Leave this column blank if there are no such areas.
6. COLUMN F - Add together all of the areas that are to be subtracted from the gross illuminated area and list here. (COLUMNS C + D + E).
7. COLUMN G - Subtract COLUMN F from B (COLUMNS B - F). This is the illuminated area to be used in OLTG-2-C. If this area overlaps any other illuminated application areas, then subtract any overlapping areas from the other application.

Illuminated Area Worksheet for Drive-up Windows and Guarded Facilities

OLTG-3-C Part 5 of 5 shall be used to calculate the area for drive-up windows and for guarded facilities in Standards Table 147-B. There are two parts to this form:

- A. Drive-up Windows

1. COLUMN A - List the width of the drive-up window plus 6 feet.
2. COLUMN B - List the smaller of the length of 30 feet or to the edge of the property line.
3. COLUMN C - Multiply the width of the window times the length (COLUMNS A x B). This is the illuminated area to be used in OLTG-2-C, Part 3 of 4. If this area overlaps any other illuminated application areas, then subtract any overlapping areas from the other application.

- B. The Area of a Guarded Facility includes the guardhouse interior area plus the product of the entrance width of 25 feet and length up to 80 feet.

1. COLUMN A - List the area for the guardhouse.
2. COLUMN B - List the smaller of 80 feet, or to the edge of the property line.
3. COLUMN C - Calculate the entrance area by multiplying the length by 25 feet (COLUMN B x 25).
4. COLUMN D - Add the area of the guardhouse interior to the entrance area (COLUMNS A + C). This is the illuminated area to be used in OLTG-2-C,

Part 3 of 4. If this area overlaps any other illuminated application areas, then subtract any overlapping areas from the other application.

Sign Lighting Compliance

OLTG-4-C shall be used to document compliance of Internally Illuminated and Externally Illuminated sign compliance in §148. This form may be used with LTG-1-C for sign applications when no other regulated outdoor lighting systems are installed, or with OLTG-1-C for sign applications alone or sign applications in conjunction with other outdoor lighting applications.

There are two compliance options for signs. Alternative 1 is based on complying with lighting power allowances per square foot of sign. Alternative 2 is based on utilizing only specific lighting technologies. Unfiltered signs (signs consisting of bare lamps) are not regulated. For hybrid signs, consisting of one or more components of internally illuminated, externally illuminated, and unfiltered components, each regulated component shall comply with Standards separately.

1. COLUMN A - The code for each sign type, as it is described by name, type or symbol on the plans.
2. COLUMN B – List the quantity of signs that are included on this line. For example, if a project has multiple signs that are identical, they may be listed together on one line.
3. COLUMN C - Describes the location of the sign.
4. Fill in COLUMNS D through L only if Alternative 1 is being used for the sign or component compliance.
5. COLUMN D - The area of the sign in square feet.
6. COLUMN E - List "I" if the sign is internally illuminated, and list "E" if the sign is externally illuminated. If a sign has both internally and externally illuminated components, enter the sign components on separate lines.
7. COLUMN F - If the sign or sign component is internally illuminated, enter "12" watts per square foot, if the sign or sign component is externally illuminated, enter "2.3" watts per square foot.
8. COLUMN G - Calculate the allotted watts (COLUMNS D X F).
9. COLUMN H - Type lamp is the type of lamp (incandescent, fluorescent or high-intensity discharge, etc.).
10. COLUMN I - Enter either the number of identical lamps, or the total lineal feet of lamps in the sign or sign component.
11. COLUMN J is the number of ballasts in the sign.
12. COLUMN K -The total designed input watts for lighting the sign or component.
13. COLUMN L - Enter "Y" if COLUMN K is smaller than COLUMN G, the sign complies under Alternative 1. If COLUMN K is larger than COLUMN G, enter "N", the sign does not comply

using Alternative 1. (However, the sign may still comply using Alternative 2 if only approved technologies are used).

14. Fill in COLUMNS M through S only if Alternative 2 is being used for the sign or component compliance. Check all lamp technologies that apply. An internally illuminated or externally illuminated sign or sign component complies under Alternative 2 if only technologies listed in M through S are used.
15. COLUMN M - Check (➡) if high-pressure sodium (HPS) lighting systems are used.
16. COLUMN N - Check (➡) if all metal halide lighting systems that are used are either pulse start (PSMH) or ceramic metal halide (CMH) systems.
17. COLUMN O - Check (➡) if either neon or cold cathode lighting systems are used.
18. COLUMN P - Check (➡) if light emitting diodes (LED) are used.
19. COLUMN Q - Check (➡) if all linear fluorescent lamps that are used are barrier coat fluorescent systems. (This includes most fluorescent T5 and T8 lighting systems).
20. COLUMN R - Check (➡) if all compact fluorescent lamps (CFL) that are used are pin-based compact fluorescent (CFL) systems. Screw based CFLs cannot be used to comply with this option.
21. COLUMN S - Check (➡) if all ballasts that are used are electronic ballasts with an output frequency of 20 kHz or more.

6.10 Lighting Inspection

The electrical building inspection process for energy compliance is carried out along with the other building inspections performed by the building department. The inspector relies upon the plans and upon the OLTG-1-C Certificate of Compliance form printed on the plans (See Section 6.9.1). Included on the OLTG-1-C are “Notes to Field” that are provided by the plans examiner to alert the field inspector to items of special interest for field verification.

6.11 Reference/Glossary

The following are key terms that are used in this section, defined in Joint Appendix I and have application to compliance with the outdoor lighting requirements of the Standards.

- Building entrance
- Landscape lighting

- Lantern
- Outdoor lighting
- Outdoor sales frontage
- Outdoor sales lot
- Parking lot
- Paved area
- Pendant
- Post top luminaire
- Principal viewing location
- Public monuments
- Sales canopy
- Temporary lighting
- UL
- Vehicle service station

